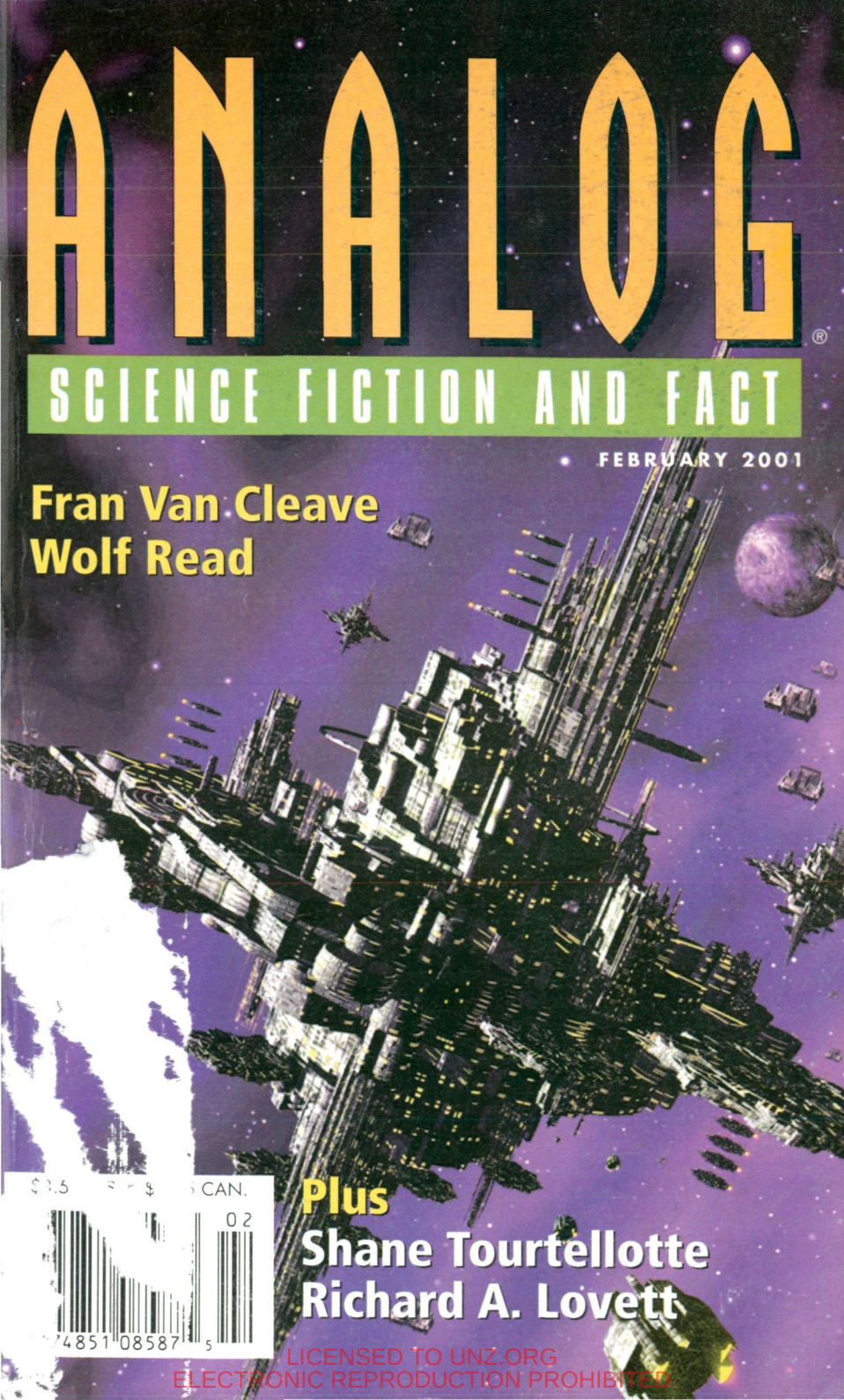

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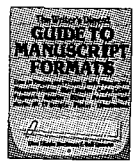

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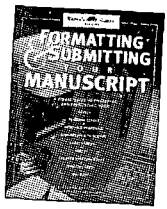

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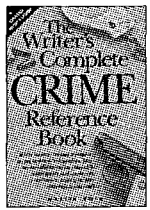

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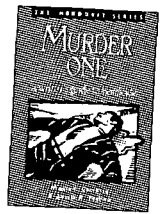

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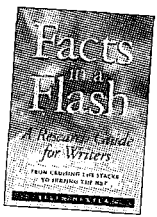

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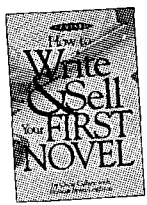

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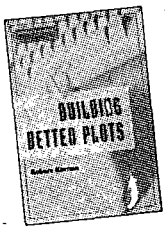

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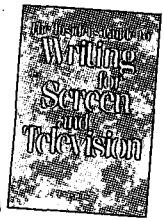

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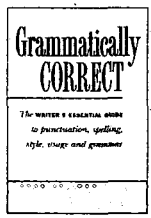

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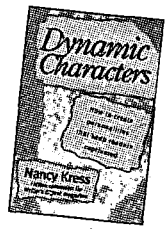

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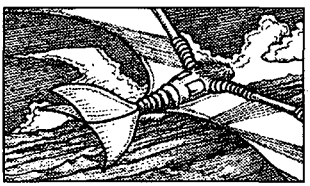

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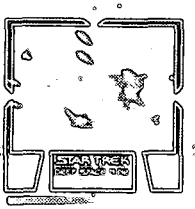

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EDITORIAL Stanley Schmidt

CHILD'S PLAY II

Humankind, as I mentioned a couple of months back, is similar to other mammals in having a long childhood during which basic skills needed for adult life are learned, largely through play. Humans are different in the extent to which adults consciously shape and guide their children's play. Since the changes produced by this guidance may or may not be entirely beneficial, it's prudent to consider not only whether the guided play serves all the purposes it should, but also the *extent* to which it should be shaped or guided at all.

The current fashion, at least in the New York area, seems to be what in other circles would be called micromanagement, with parents and teachers planning virtually every minute of their children's lives—even during "vacation" periods. Vast numbers of toys are designed expressly to promote development of this or that set of skills. After-school hours are frequently filled with organized activities like sports and lessons in fields like ceramics or music or dance. Sometimes that's because the child *wants* to do all those things and considers the opportunity a privilege; but too often it's because parents want their children to be as Enriched as possible, even if it means driving them to exhaustion and neurosis. Schools are showing a creeping tendency to assign supplementary homework over traditional vacation periods. "Suggested" summer reading lists have been around for a long time, but they are now increasingly *required*, with tests on them given in the first week of school.

If you can't remember how you would have felt about *that* when you were a student, either your memory is going or you've been out of school too long.

Well, what's wrong with a dedicated effort to make sure as much of students' time as possible is Productively filled with Learning Experiences? After all, it's for their own good. . . .

I don't doubt that many of the parents and educators fueling this trend really believe that, but I keep thinking of where good intentions are used for paving stones. Right off the top of my head, I can easily think of several objections to this trend.

Filling every minute with structured, consciously directed educational activities leaves little or no time for unstructured, undirected educational activities—which may, at least for highly creative kids, include some of the most important ones. It also leaves little or no time for unstructured, undirected activities—or lack of activities—which may not be educational at all, but which everybody needs to maintain good psychological health.

It assumes that the adults doing the structuring and assigning know all that needs to be known about what every kid needs or would like to learn, when the truth is that no structured program will cover all possible subjects. Letting structured programs expand to fill all available time means no time is left to

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explore things *outside* the program. (Want a close-to-home example? To many of you reading this, science fiction has long been an important part of your life and quite likely your education—yet until very recently, most schoolteachers not only refused to teach it, but actively discouraged reading or writing it. In my case, I would never have discovered what is now my main profession if I had counted on the schools to tell me about it.)

Last but by no means least, assigning full-time activities may have the opposite of the intended effect. We're told, for example, that one goal of summer reading programs is to encourage kids to develop a love of reading. But it's pretty elementary psychology that forcing people to do things they don't like, during times when they were counting on a break, is not at all likely to make them love the activity in question—but it may make them hate it.

By now I've mentioned reading, and in particular extracurricular reading (in which, for the moment, I include both the genuinely extracurricular and the ostensibly-but-not-really extracurricular) several times. Some of you may wonder what this has to do with my title, which mentions play, not reading. Well, one of my central points is that people need some time for play in the most general sense—activities engaged in not to achieve some specific, serious goal, but primarily for fun and to experiment with new concepts, ideas, and experiences. That can certainly include intellectual play, and I suspect that for many of you reading for pleasure has long been one of your major forms of play. But I don't want to give the impression that reading is my primary concern here. It isn't; I think it's just as important to have time available for swimming or bicycling or playing computer games as for undirected reading.

But directed reading happens to be one of the currently most prevalent threats to that time, which is the other reason I'm giving it a good deal of my attention here. As I write this, in midsummer of 2000, my local newspaper has for some weeks been full of controversy over mandatory summer reading programs in local high schools. It was touched off when one mother dared to object to one such program and try to get it removed. She and her son, who loved to read but wanted to use summers to read books of his own choosing instead of somebody else's, were written up in a prominent article, which subsequently drew lots of letters to the editor.

Many of those letters, predictably, relied on "straw man" arguments, distorting what the original article said to make a better target for the letter-writer's barbs. Some just missed the point. Most of them, whether on target or not, supplied interesting insights into how people think about these things. One jumped on the protesting mother's observation that the required reading list

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included things not of interest to at least some students, and ranted that there are many things students have to read and learn in school that might not interest them.

Well, of course there are, and an excellent case can be made that there should be. I've done it myself; people cannot know what is of interest or value to them unless they've had some exposure to it. One of the functions of a good school is to provide exposure to a wide range of subjects, so that students will have a larger selection available as they find out where their interests lie.

The crucial point this letter-writer missed is that that is supposed to happen *in school*, and vacation time is *not* part of school time—or at least, it hasn't been and shouldn't be.

There is more that can and should be said about the summer reading issue *per se*, and I'll say some of it here. I don't want to dwell on it too long, because it is not my main concern. But many of the same arguments might apply to any other "enriching" activities schools decide to insinuate into vacations.

One highly intelligent person who happens to be an avid reader and was never subjected to these programs says that she wouldn't have minded if she had been, because she read so many books anyway that a few more would hardly have been a burden. She also correctly points out that many students wouldn't read *anything* during the summer if not forced to. But does everybody have to be a reader? And is forcing them to read things they don't like, especially during what they've been told is vacation, going to turn them into readers? Or is it more likely to turn them off of reading altogether?

Personally, I have a slightly different perspective, since I *was* subjected to an early version of these things. Mine was not quite like some of the current crop, in that we were not required to read everything on a specific list—but we were required to read a specified number selected from a list of "suggestions." And the truth can now be told: I resented it, emphatically and unwaveringly. Not because I didn't want to read, but (in part) because I entered every summer with a list of things I'd already decided *on my own* that I wanted to read. Those lists included good, solid stuff; I would still say that more of my education came from those independent pursuits than from most of the classes I took. They were also *long* lists; even without assigned summer reading, I

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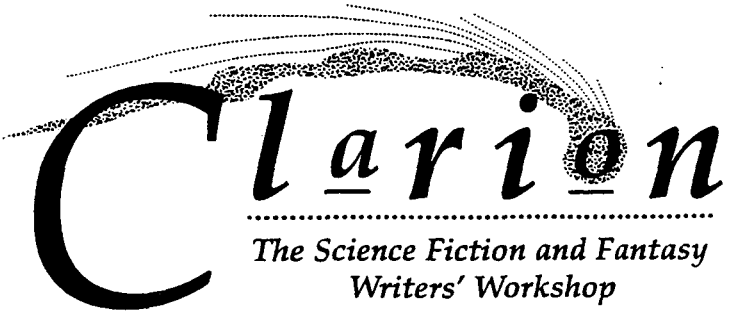

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would seldom have been able to get through everything I wanted to. And every book I read from *their* list meant one fewer that I could get around to on *my* list.

Admittedly I was not a typical kid. Neither was the avid reader in the previous paragraph. Many kids probably do need some nudging to get them interested in reading, if they're going to get interested at all. But there are better ways to do it. The schools have their chance during the academic year; if they can't succeed then, I don't think we can count on them to do better by doing more of the same when they're not even supposed to be in session. There are, however, things that they could do that might actually be appreciated—like providing lists of *suggested* books that are exactly that. Suggestions, not requirements—no deadlines, no quotas, no tests at the beginning of classes. And if they wanted to be *really* radical and sneaky (and effective), they could make sure the list included a goodly proportion of books kids would actually *like* to read. Nobody who's been watching the current *Harry Potter* fad can seriously maintain that "kids don't want to read any more." Give them something they *like* to read, and they'll read it; fail to do that, and they won't. Just like you, dear readers, for whose beer money all of us in commercial publishing are competing.

Even if I had loved everything I was required to read (which I did not, though I didn't hate it all either), I still would have objected on principle. In the programs I was taking, by the time I reached high school, school involved a *huge* amount of work and pressure. My classmates and I periodically had a real need to interrupt that with vacations that were really vacations, just as most adults have a similar need to interrupt their work routines from time to time. And therein, I think, lies what I find most insidious about the trend toward assigning and scheduling work around the clock and around the calendar.

It's a long-range danger, but a very real one, and it's being seriously exacerbated by certain new technologies and the ways people are using them. My biggest objection to such programs is that they blur the distinction between work and vacation. And it isn't just summer reading lists. New York state recently enacted a tougher set of standards that all high school graduates are required to meet, and suddenly schools, parents, and students are frantically obsessed with trying to meet them. "With the new standards and the push for higher passing rates," one school superintendent was quoted as saying, "[vacation] is no longer time to just rejuvenate. It's time to complete late assignments, work on long-term projects and prepare for the assessment tests."

That view seems to me seriously lacking in perspective. Far be it from me to deny that we need higher standards for things like basic language and math skills, but I think that principal needs to give serious consideration to the profound point made with admirable succinctness by a ninth-grader quoted in the same article: "It's not really a break when they just give us more work." And the corroboration from the clinical psychologist who said, "People under stressful situations on an ongoing basis start to break down, physically and emotionally. There's a need for the kids to get away from the requirements of structured, academic learning and find a different setting . . . where they can relax."

Substitute "adults" for "kids" in that last sentence, and "employment" for "structured, academic learning," and the result is just as true—and in just as much danger of being forgotten. There has been a trend in recent years (and some sign of a reaction setting in now) toward blurring the distinction between work and vacation. People are compelled, or at least feel compelled, to take work along on every trip, or to check their e-mail and call the office every day, or to

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keep their pagers on even at the beach.

But if you do that, what you have is not a vacation and can't serve the vital restorative function of one. Similarly blurring the distinction between school and vacation may be, in some cynical sense, good training for that kind of adult world. But that's a kind of world we should be veering away from, not accelerating toward, and conditioning kids to regard it as normal is no way to do that. Some kids will grow up to be employers, and many of them employees. In either case, if they've never had the chance to learn the concept of a clear separation of working-for-others time and playing-for-yourself time, it may get permanently lost.

So in sum, when I ponder whether the current attitudes toward planning children's play are allowing it to serve its main purposes, I conclude that there are some real problems that warrant adjustment. I respectfully submit that maybe kids "on their own time" need fewer specific assignments and more really well-chosen *suggestions* that carry no more force than that; fewer toys geared toward specific Educational Goals and more really simple props like cardboard boxes and water that require them to use their own imaginations; fewer hours spent with other people's virtual reality simulation games and more in front of a blank screen with good word and graphics processors.

And, above all, less time planned for them and more that they themselves can—and must—decide how to spend. As another student wisely pointed out, the school year already provides lots of chance for kids to explore the world and learn things they need under careful adult guidance. Vacations should provide a complementary opportunity for them to explore options on their own. They need both. Let's make sure they have both—and that *has* to mean keeping them separate. ▩

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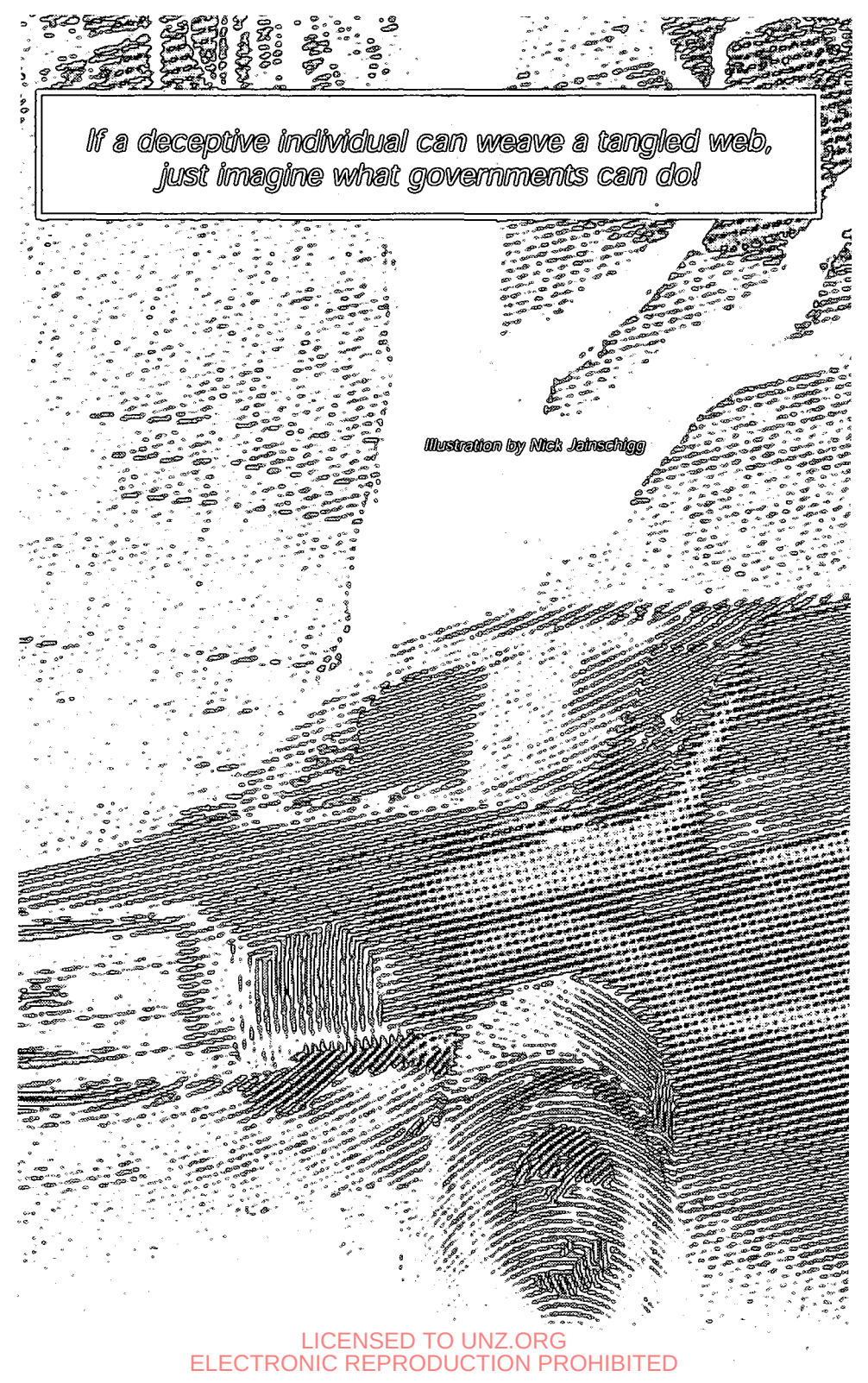
If a deceptive individual can weave a tangled web,
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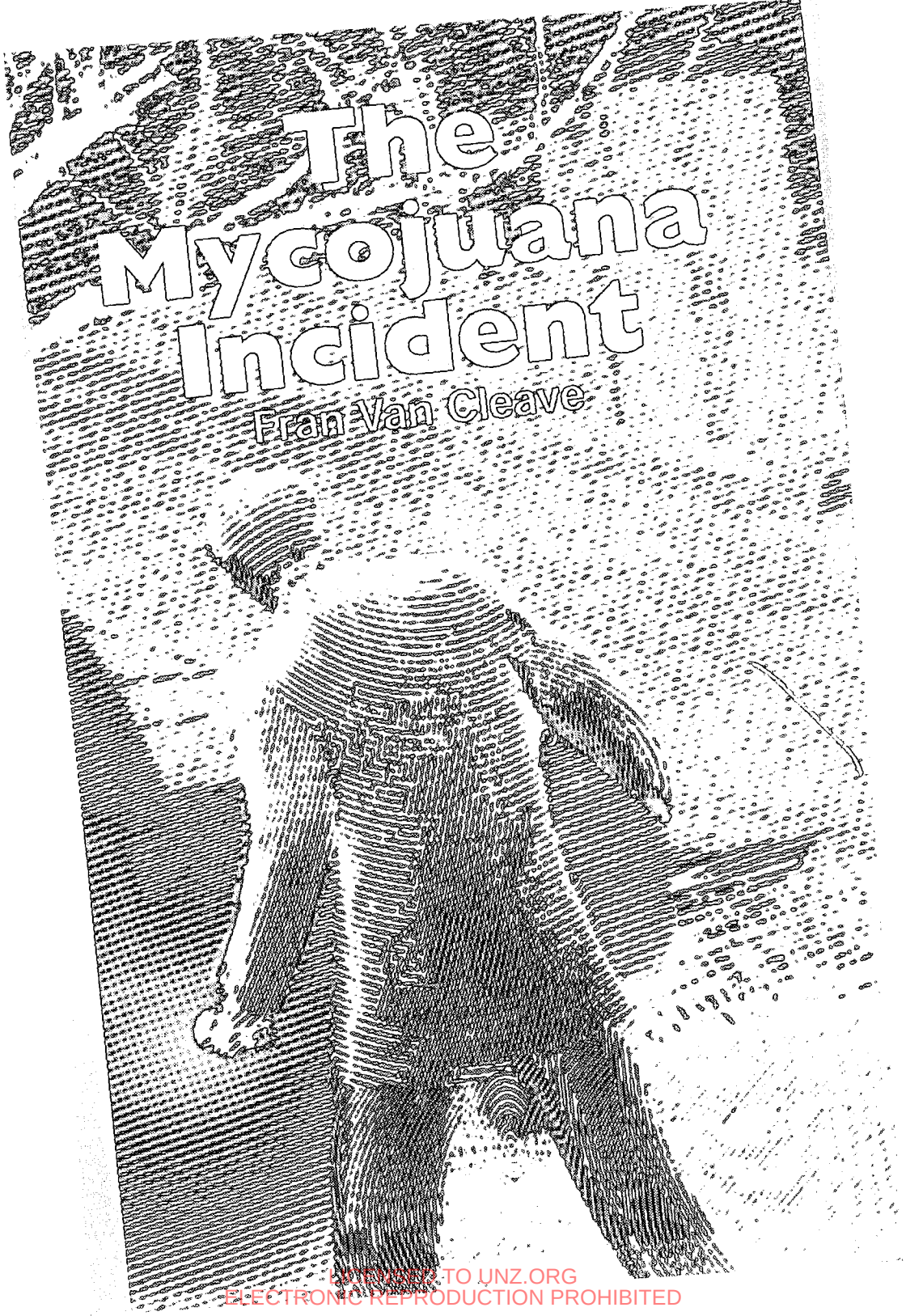
The Mycojuana Incident

Fran Van Cleave



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Frank Murphy stared at the chest X-ray in disgust. When he made it to Moonbase—when, not if—he promised himself he would never have to deal with patients like Elmo P. Hackleford ever again.

While injured pioneers in vacuum suits had an annoying tendency to die rather suddenly, at least they didn't commit suicide on the installment plan.

"What's wrong with me, doc?" Elmo quavered. He was sitting on the exam room table in his overalls, his pet raccoon, Spot, curled in his lap. Frank had tried to evict Spot during Elmo's first exam, an activity he now regarded as futile.

"You have pneumonia, Mr. Hackleford. The 'shine you've been drinking has hurt your immune system. It probably contributed to the fungus growing on your nails, as well."

Elmo's bristly gray eyebrows collided over his big red beak. "Don't feel like the pneumony. I done had it five or six times, and it wa'n't never like this. 'Sides, if 'shine's so bad for me, how'd I get to be so old?" He cackled and dissolved into a coughing fit.

Spot rested his muzzle on Elmo's gnarled hand and crooned anxiously.

"Have a Kleenex," Frank said, handing him a fistful. The mystery of why it took some people an inordinately long time to succumb to their bad behavior had been around as long as medicine, and would not be solved by him. Elmo had been Kallikak County's biggest moonshiner for the past forty-seven years. "Sixty-five isn't old for most people anymore. But you're aging faster than you should, and one of the signs is getting things like pneumonia. The disease itself changes as you age. Oftentimes it becomes more virulent."

"Huh?"

"Uh . . . harder to get rid of. Now, I'm going to give you some Gentian Violet to put on your nails, and some free samples of an antibiotic. If you're not feeling any better by tomorrow, you'll need to go to the hospital."

"Fergit that."

"You probably won't have to go. I just want you to be prepared in case the antibiotic doesn't work. That happens once in a while. For some reason, nobody knows why. . . ."

"I ain't never been to no hospital, and don't aim to start now!" Elmo declared, his frosty blue eyes bright as fox-fire. "Anyhow, it ain't the pneumony. I wants to see ol' Doc Pete."

Since Frank's arrival at Ozark Mountains Hospital two weeks ago, he'd become accustomed to this demand, if not entirely inured. "Dr. Petrovich isn't in clinic today. He's got a patient over at the hospital who's keeping him very busy."

"Don't bother me none. I can wait."

"Look, if I tell him you want to see him when he gets back, will you promise to go home, get some sleep, and take your antibiotic?"

Elmo pursed his lips. "Which first?"

Progress! "The antibiotic first. Once a day with a full glass of water." Removing a couple of boxes of Dynamiflox from the glass-fronted cabinet, Frank tore open the foil and popped out a pink capsule, then filled a Dispoze cup at the sink. "Here."

The old moonshiner stared at the capsule, puzzlement wrinkling his face like ripples on a pond. "What in tarnation's that?"

Frank sighed. "That, Mr. Hackleford, is your antibiotic. You swallow it."

"Huh?"

"It's a new one. Dynamiflox. Now, down the hatch."

Elmo protested that he'd never agreed to such a thing. Frank felt his Irish temper stirring, took two strides to the door and yanked it open. "Sherri Lynn! Would you come in here, please? I need your assistance."

Sensing his master's agitation, Spot hopped off the table and sank his teeth into Frank's shoe. The animal was big for a raccoon—a good thirty-five

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pounds—and from the growling sounds he was making, he meant business.

"Hey! Get him off me! He might be rabid!"

The old moonshiner grinned. "Aw, Spot wouldn't hurt a fly. He's just being friendly."

Sherri Lynn Jasper, the nursing assistant, appeared in the doorway. Her willowy good looks, plus her membership in the local snake handler's church, made Frank uncomfortable—he didn't know which bothered him more—but the patients doted on her. "Dr. Murphy, what would you. . . . "

"Help Mr. Hackleford take his Dynamiflox, then paint the last two nails on both hands with Gentian Violet. I'm fresh out of compliance strategies." Gritting his teeth, Frank got busy peeling the raccoon's paws off his ankle. By the time he finally removed the stubborn procyonid, Elmo had swallowed his antibiotic, stood up, and was rubbing his back against the corner of the wall, eyes half closed in ecstasy.

"Back itches like a sumbitch. Boy, that feels good!"

Quickly and efficiently, Sherri Lynn painted his nails and waved them in the air to dry. Frank handed him the raccoon and two boxes of Dynamiflox. "I'll see you a week from today for follow-up. Don't forget to take this every day."

"Yeah, sure." The old man kicked open the door to the supply closet and stood looking at it in bewilderment.

Sherri Lynn took his arm. "C'mon, hon, I'll show you out. I just put fresh molasses bread in the waiting room, so you can help yourself if you've a mind to."

"Why, aren't you a sweet child," the old man wheezed. "You ever try any of Hackleford's Heavenly Moonshine? It'll make you dance for joy. . . . "

Hope it's better than her last culinary disaster, Frank thought as he leaned out the door after them. "Be sure to drink plenty of fluids, Mr. Hackleford! No alcohol or caffeine, but lots of hot soup and herbal tea!"

Frank didn't think any more about Elmo's nails, his itching, or his forgetfulness. Forgetfulness was a natural part of aging, exacerbated by overindulgence in alcohol.

That was Frank's second mistake of the morning.

By late afternoon, Frank had seen and treated a couple of dozen summer colds plus two cases of strep throat, casted a fractured tibia (kicked by horse), put twenty stitches in a calf wound (ax slipped while woodcutting), and removed a fishhook from a boy's ear. Prosaic, par-for-the-course country medicine. He didn't miss the high pressure of UCLA, but it did make him wish for more of a challenge.

None of the patients seemed exactly thrilled to see "the city boy," but Frank reminded himself that that was okay. All right, so he'd romanticized a little about how grateful these poor ignorant hillbillies would be for his knowledge of modern medicine. The reality was, he couldn't do that much here. Ozark Mountains Hospital had a CT scan and an OK lab, but lacked an intensive-care unit and the budget to do any cutting-edge treatment. And he didn't want to replace their beloved "Doc Pete"—heck, he wouldn't put himself in that position for all the helium-3 in Mare Anguis. All he wanted to do was pay off his medical school bills and leave.

With luck, off this crazy planet entirely.

Ignoring the noises his stomach was making about dinner, Frank finished writing the last of his notes in the charts, then poured himself a cup of Sherri Lynn's coffee—as good as her bread was terrible—and sat down at the antique rolltop desk in his office with his Notebook.

The computer had obediently flagged all the latest news of the second Artemis mission, leaving it on his opening screen. He scanned quickly through it

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until he got to the part about the successful expansion of the base into subsurface lava tubes. The increased movement on the mining infrastructure was great, but expansion . . . that meant a permanent community. Which meant they'd need a medical doctor. Frank had sent them his C.V. months ago, but he hadn't heard anything back.

Yet.

Frank sighed. In the meantime he'd become physically dependent on his Notebook, the news and e-mail dumping endorphins into his system like the worst kind of junkie. Or maybe he simply needed regular reassurances that the world of 2012 was still out there. Not the snooper-cams generating faster than spermatozoa, and the perpetual demands for one's retina print in order to buy the tuna special, but the world of books and ideas, of those who thought outside the box and beyond the horizon, men and women both. . . .

But especially the women.

"You have mail," his Notebook said. The first was from a former med school classmate, Alyssa Marcello, now pursuing a 'piled higher and deeper' in mycology at the University of Victoria, British Columbia. He and Alyssa had broken up two years ago; she was his favorite ex-girlfriend.

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Deity snickers

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Deity snickers

>> Stinkhorns are proof of God's grotesque sense of humor.
>What is a stinkhorn?
An order of mushroom.

The time-stamp showed that the message had been sent just minutes ago. Frank smiled and dashed off a response.

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Deity snickers

Uh-oh. Your dissertation is causing you to see every aspect of the Universe in a mushroom rather than a grain of sand. *Please* tell me this isn't one of those hallucinogenic mystical things.
—Frank

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Deity snickers

Not to worry, Frank baby. This is hard science, grounded in the evolutionary strategy of the stinkhorn. You see, the mushroom bears a remarkable resemblance to a human phallus, right down to the yucky mass of spores at its zenith, which looks just like . . . well, take a wild guess. At the risk of sounding prejudiced, I hasten to add: its yuckiness arises from the spores' peculiar aroma, which attracts flies, which snatch up the spores and carry them wherever flies go. Thus making the humble stinkhorn a <smashing> reproductive success. If that isn't a grotesque sense of humor, what is? >:D

Frank was pondering various responses—all of which seemed inadequate—when the back door banged and a Russian-accented voice called, "Frank, you are still here?"

"In the office."

The floorboards creaked in the hallway, and then Dr. Alexander Petrovich came into the office and threw himself into the overstuffed chair to the left of the desk. With his thick white hair and slate-blue eyes shining out of a pink-cheeked, white-bearded face, "Doc Pete" resembled Santa Claus from the neck up. From the neck down, he was

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Buffalo Bill: silver-and-turquoise bolo tie, Western shirts so bright they threatened the unSolaraided optic nerve with imminent paralysis, faded Wranglers, cowboy boots. Today's shirt was coral-snake-red with pearl snaps, his black pointy-toed boots feather-stitched in the purest white. "Ah, but of course—you are online. How did it go today?"

"Fine. How was the delivery?"

Petrovich sighed. "A difficult breech; Mae Etta's a tiny thing. I was thinking I needed to AirEvac her to St. Louis when I finally got the baby turned. A fine healthy boy, nine pounds, six ounces."

Frank didn't want to think about what kind of future the poor kid had in store for him. Watching the country go broke paying for the Pan-Asia War as his elders fled the eighty-percent tax rate? Maybe he'd grow up to be a Marine in his very own self-propelled howitzer, patrolling the streets of big cities here at home. *Wow.*

". . . have dinner with me in town at The Pot 'n Spoon?" Petrovich was saying.

Frank had only eaten once with Petrovich, his first night here. He didn't want to be rude to the old duffer, but he was feeling pretty guilty about skipping his exercise routine the last two mornings in a row. Any place calling itself "The Pot 'n Spoon" had to have a menu loaded with empty carbs and saturated fat.

"Actually, I'd planned to eat at Ruby's Cafe a little later."

"She is closed tonight—painting the front room, I think. Do not worry about us both being away from the hospital compound at the same time. It is only nine minutes into town, and we both have our portables."

Frank decided there was no way he could refuse without sounding rude. "Sounds good. Let me change first."

Five minutes later, attired in Levis, sneakers, and a blue t-shirt featuring a picture of the Virgo Supercluster and an x marked "You are here," Frank jumped into Petrovich's seven-year-old Chevrolet sport-utility vehicle, and the two of them headed up the zigzag mountain road into Rockytop Ridge.

Perched atop a rugged mountain pass the locals called "Top o' The World," the town of Rockytop Ridge was one of the last bastions of "unspoiled America," which made it a big hit with the vacation crowd. Though it was only Thursday night, Frank was already bracing himself for the upcoming Labor Day weekend.

Frank realized he was sitting on something, and pulled out an envelope of Wal-Mart photos. "I hope this wasn't anything important."

"No, no, just camping photos. Throw them on the dash. I forgot to ask you—how is Dan?"

"Hillman? Same as usual, I guess," Frank replied, gazing out the window at the rugged slope of woods plunging down from the road. *That is one steep grade.* "He's got an appointment on Tuesday."

The older man frowned. "This morning, he called me at the hospital complaining of headaches and blurred vision. And he said his lungs were so congested he thought he might have pneumonia. I was in the middle of things with Mae Etta, and told him to come right in and see you."

"Well, he didn't. Maybe he didn't feel like driving with blurred vision."

"He said he'd come in. He knows that road like the back of his hand."

"Well, obviously he changed his mind." Frank knew little of Hillman personally, since the man preferred to see Petrovich in between visits to an oncologist in St. Louis, who kept tabs on his lymphoma remission. Probably Hillman decided to pop some aspirin and go to bed rather than drive under those conditions.

"That is not like him." Petrovich chewed his lip, then retrieved his flip-phone, opened it, hit two buttons with his thumb. He held the phone up to his

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ear, then waited. Presently he tried another number, then folded up the phone. "No answer at either of his numbers. We had better go see if he's all right."

Frank's stomach rumbled. "Tomorrow?" he asked hopefully.

"No, tonight." Alex swerved into a U-turn, spraying gravel and barely missing a black-and-tan bull, which had appeared seemingly from nowhere. "The Hillman farm is about twenty miles south of the hospital on Crooked Snake Trace. Won't take us more than thirty minutes to get there."

"Can't we just send the ambulance?" Frank looked in the side-view, and was alarmed to see the bull trotting after them.

"No." Petrovich stepped on the accelerator. To Frank's relief, the Chevy responded with alacrity. "I believe this to be an emergency, since Dan is never without his portable phone. But I do not want to tie up our only ambulance in case I am wrong. I can get there just as fast."

Frank couldn't imagine why Hillman wouldn't have called back the minute he'd begun to feel worse. Unless he really hadn't wanted to see Frank . . . but no, that was ridiculous. No cancer patient was *that* fussy about who he saw. He'd decided to blow it off. As for the phone, everyone had to charge their portables sometime.

Resigned to a late dinner, Frank snapped on the radio—ancient as it was, it didn't respond to voice commands—hit the scan button, and settled back in his seat. ". . . top story, American forces took Pyongyang today, routing the KPA from the city in a stunning victory. Enemy casualties are numbered in the hundreds of thousands. No exact figures yet on American casualties, but estimates hover in the low ten thousands. . . ."

The sun was hanging about an inch above the blue-misted trees in the west when Frank and Petrovich arrived at the Hillman property. It was a pretty place, with lots of greenery and a stout, well-kept fence of lavender stone block.

"Likes his privacy," Frank observed.

"It is necessary," Petrovich replied tersely. "Only, look—he left the gate open."

They drove closer. There didn't appear to be any vehicles in the driveway. Then Frank saw a glint of chrome off to the left, beneath a huge spreading willow. "Is that his truck over there?"

"Yes."

The truck, a dark gray Ford, was just visible beneath the hanging branches near the end of the driveway. Unlike most Ozarks males, Hillman wasn't the sort to park vehicles on the lawn.

Frank sat up straight, adrenaline flooding his system. Hillman might've had a myocardial infarction, or been the victim of . . . well, obviously not a car-jacker, since his vehicle was still there, but some sort of assault.

Alex parked the SUV, then opened the glove compartment and removed a couple of blue nose-masks and two pairs of hospital gloves. "Just to be paranoid, let us put these on."

Frank didn't argue. He slipped the elastic over the back of his head and settled the mask over his nose and mouth. "Let's go."

They jumped out and headed for the truck. Gravel crunched under their feet, and the wind sighed in the trees, soft as breath. In this heat, even the crickets were silent.

Frank couldn't take his eyes off the darkened cab. Was that Hillman slumped over the wheel? Or was it only a shadow from the willow tree?

Why was he getting so spooky about the possibility of a corpse? He'd seen hundreds at UCLA. The Coleman Incident made the ER look like a slaughterhouse. . . .

Yeah, but it's different when you find one yourself. Why that should be, he didn't know. The fact that it was August, probably the worst month to find a dead body in a car in North America, did not

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register in his usually analytical mind.

Petrovich laid his hand on the door-latch, then stopped. *"Bog!"* he exclaimed. He didn't back away, but from the expression on his face, he looked as if he wanted to.

Frank looked in the window, and immediately regretted it.

Something curled up on the seat—it had to have been human, since it wore a plaid shirt and blue jeans. But a veil of some white, misty stuff obscured the upper part of the face. The mouth yawned open, exhibiting the victim's silver fillings, while the eyes. . . .

Frank gagged, whirled, and vomited in the driveway. He managed to get his mask off in time, barely. The iron constitution acquired at UCLA had definitely rusted.

"Frank, move upwind! I am opening the door."

Frank took a half-dozen steps up the driveway, away from the truck. Turning, he saw Petrovich reach in the truck and take the bony wrist in his hand.

Petrovich was crazy. A mask and gloves were imperfect barriers, everyone knew that. Why risk your life to take the pulse of a man obviously dead?

Frank pulled his mask back on just as the wind shifted, giving him a whiff of the truck's interior. It was enough to start him puking again.

By the time he straightened up, Petrovich had shut the door and returned to the SUV, where he was talking into his portable. ". . . probably all afternoon. No, I really cannot say . . . he will need sterile containment . . . no, I'll take care of the other calls. Thank you, Sheriff. See you soon." He disconnected, then reached under the seat and removed a container of bottled water, which he handed to Frank.

Gratefully, Frank took the water from him, rinsed his mouth two or three times, and spat. His stomach was still queasy, but as long as he didn't look in the truck, he was all right. "What the hell happened to him? Some deadly new Ozark fungus? How could it grow so fast that he could still climb in there, but not drive any farther than this?"

The older man shook his head. "I do not know, Frank. I have never seen or read of anything like this. You may have found more than you bargained for in this little outpost"

"So is that Hillman in there?"

"Yes. Nothing we can do for him now, other than find out what killed him."

Frank shuddered. "I hope his remission was over. Because if he was capable of mounting a normal immune response, we are in big trouble."

While they waited for the sheriff to appear, Alex called St. Louis to find someone to do the autopsy, then the Center for Disease Control in Atlanta to report the possibility of a deadly new fungus.

Frank had always found inaction maddening. He wanted—needed—to solve problems, or at least study them. With an uneasy glance at the house, whose sunset-pink windows seemed to be staring at him like bloodshot eyes, he began walking up the driveway. Soon this place would be swarming with CDC types, tearing it apart looking for clues. How good a job they would do was anybody's guess.

With all the excitement being generated by the new biological robots that had just been invented in British Columbia, and seeing how the FDA was—as usual—sitting on a decision about letting *any* experimental trials be run in America . . . well, it didn't give him a whole lot of confidence in medical authorities.

What would be the simplest explanation for Hillman's death? The house had lots of indoor particle-board, thus exuding formaldehyde which wreaked havoc on Hillman's already compromised immune system, leaving him wide open for any sort of opportunistic infection from the bugs we carry around with us all the time.

He remembered a case study he'd read once, of a severely immune-defi-

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cient woman who accidentally cut her tongue on a knife with which she had sliced moldy bread. An hour later she complained of feeling ill; another six hours and she was comatose. The bread mold had invaded and colonized her central nervous system. Despite immediate hospitalization, she was dead within forty-eight hours.

"Frank!" Petrovich shouted. "Stay out of the house!"

"OK, OK." Frowning, Frank turned, and stood looking across the lawn at the garden. Filled with pink and red roses, orange and gold snapdragons, and a bewildering variety of old-fashioned flowers, it was extraordinarily lush for this part of the country. For anywhere, really. Hillman must've been quite a gardener.

That gigantic greenish-brown bush back there . . . what was it, a castor bean? It had no flowers, though. The fan-shaped clusters of five-lobed dentate leaves looked an awful lot like . . . marijuana. . . .

Red and blue lights flashing, the sheriff's car pulled up at the end of the driveway, a cloud of dust whirling about it like their own personal tornado. Two men emerged from the car, both wearing khaki uniforms with the blue and black patches of the Kallikak County Sheriff's Department. Frank knew that the short, sandy-blond one was the sheriff, the tall, dark fellow his deputy. It didn't take a degree in jurisprudence to know how law enforcement types felt about marijuana. Hopefully that wouldn't keep them from giving their full attention to a dead body, but in a place like Kallikak County. . . .

Frank hoped he was mistaken about the plant.

Muttering a prayer to the gods of chance, Frank jogged over to the SUV. Petrovich introduced him to Sheriff Lee Kinswell and Deputy Jim Atwater.

Kinswell shook his hand. "Pleased to meet you, Dr. Murphy. I've seen you around, here and there." He packed a lot of muscle on his short frame, but lacked the aggressive manner to go with it. He had a pleasantly firm handshake and an open, friendly face.

At least he didn't wear mirror shades and chew tobacco.

"Nice to meet you, too, Sheriff." Frank told himself not to be taken in by superficial appearances. Good ol' boys always looked friendly—right up until they started beating you with phone books.

Deputy Atwater shook hands quickly, all business. Tall, lean, sun-browned, with close-cut black hair and gray eyes, he was good-looking enough to play a sheriff in the movies. "Sorry to meet under these circumstances, Doctor. I take it the deceased is in that vehicle over there?"

"Yes, that's right," Frank replied.

Kinswell and Atwater strode toward the truck, keys jingling and service holsters slapping their thighs.

Alex cleared his throat. "I wouldn't advise opening the door until the ambulance arrives with the sterile containment material."

Kinswell stared in the window. "That's a big ten-four."

"Jesus." Atwater stepped back, exhaling. "*Nobody* ought to go like that."

"Hate to think how he suffered," Kinswell said, turning away. "Dr. Pete, what's your take on this?"

Petrovich retrieved a Ziploc from a box in the back of the SUV and shut the door. "It appears that Hillman was attacked by some sort of fast-growing parasite, probably fungal in nature. More than that, I cannot speculate."

"Bet it had something to do with that messed-up immune system of his," Kinswell remarked.

Frank blinked. Since when did cops know anything about medicine?

"When's the CDC planning to arrive?" Atwater asked.

"Tomorrow, perhaps." Petrovich mopped his ruddy face with a handkerchief.

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Kinswell squinted at the house. "Boy, that puts us in some kind of spot, don't it?"

Atwater nodded. "I say we dig up the plant and throw it in the woods behind the fence. Don't try to burn it, just leave it on public land."

Frank felt as if he'd wandered into the middle of another conversation. "What plant?"

"Why, the marijuana plant," Kinswell said. "Didn't Hillman tell you about that? He said he never would've gotten through chemo without it."

"He didn't mention it," Frank said, looking accusingly at Petrovich.

"He qualified for that federal marijuana program," the deputy added, "but then they never would give him any. Shameful, giving the sick hope and then taking it away."

"Well, if we don't get rid of it, the feds'll confiscate what's left of his estate. Likely his brother won't have enough left to bury him." Kinswell started toward the garden, accompanied by Petrovich.

"That's a fact," Atwater said, falling into step beside them.

"I am sorry I didn't think of it earlier," Petrovich said. "I would have spared you the trouble."

"Don't worry me none." Kinswell laid a hand on his shoulder. "I expect you were a little shook up. You've known Dan how long—four years?"

"Five."

Frank scurried after them. "Uh, this is not exactly the tack I expected you gentlemen to take. It's, well, it's. . . ."

Atwater turned his gray eyes on Frank. "Our neighboring state has three cash crops: tobacco, marijuana, and votes. It's like that throughout the South. The politicians do as they please, and crucify the little guy—for his own good, they say. Well, it's not that way here. We take care of our own."

Frank nodded as if he'd expected him to say that. While he was all in favor of cancer patients obtaining their marijuana, and favorably impressed by the sheriff's acumen in such matters, the notion of men on the sheriff's department covering up such activity by altering the scene of a death struck him as the nearest thing to anarchy.

As they approached the marijuana plant, it became obvious that something was wrong with it. The leaves were more brown than green, and hung from the branches like limp spaghetti. Clinging to the branches was a white mildew-like material.

"Hmm," Petrovich said. "It may be that this is our culprit. If the autopsy reveals spore colonies . . . well, we'll see." He broke off a mildew-entwined branch and bagged it in the Ziploc.

The sheriff whistled and pushed his hat to the back of his head. "Doc, you got a bag full of dynamite there. If that's what I think it is. . . ."

"Let us not jump to conclusions, my friend."

Something clicked in Frank's brain just as the bottom seemed to drop out of his stomach. "By any chance, does Elmo Hackleford live around here?"

Kinswell pointed. "Right across the hollow."

The ambulance was due to arrive shortly, so the two MDs went to Elmo's place with Atwater, leaving the sheriff to guard the body.

"If that thing's what made him sick, we can't dispose of it," Kinswell said glumly. "Damn, but won't this get the feds hot and bothered!"

On the way over, Frank told Petrovich about Elmo's pneumonia, his nail fungus, forgetful behavior, and his request to see Petrovich.

The Russian looked steadily at Frank. "Do you still think it is pneumonia?"

"I . . . I'm not sure," Frank confessed, exhausted by the effort required to look Petrovich in the eye. "The chest X-ray did seem a bit equivocal. There were one or two bordered areas instead of a completely diffuse infiltrate. I should've

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done a culture, but it just seemed so obviously pneumonia. . . ."

"Mm. Well, we do not know yet what is going on. Either way, we have a puzzle to solve."

Frank was grateful for his reticence, but could not lie to himself. He hadn't paid enough attention to Elmo's diagnostics because he neither liked nor approved of him. The realization left a sour taste in Frank's mouth.

Elmo Hackleford's place looked as sloppy as Hillman's was neat. Maybe the lowering dusk was to blame, but Frank didn't think so. The wooden fence, gray with years of sunlight and rain, was falling to pieces. Ditto the equally decrepit barn. A rusted Willys truck, at least half a century old, lay propped up on cement blocks on the lawn. The tarpaper shack, incongruously bracketed by a magnolia tree and two magnificent sugar maples, looked as if it were held together with equal parts luck and baling wire. A few tubercular-looking chickens pecked half-heartedly around the small vegetable garden. The odor of sour mash and fermented peaches hung over the place like an alcoholic fog.

Petrovich leaned on the horn, then stuck his head out the window. "Halloo in there! Anybody home?"

No answer.

"One of his kids or grandkids comes by every couple of days, brings him food," Atwater said. "I don't see any cars, though. Just Elmo's scooter." He pointed to an electric-powered scooter leaning against the barn. Unlike bootleggers of old, Elmo didn't screech around the mountains in a souped-up truck, delivering barrel after barrel of moonshine. His customers came to him.

"Well, what are we waiting for?" Frank said crossly. His feet felt as heavy as lead as he slid out of the SUV, and his palms were sweating. If the old man died from this, it'd be all his fault. Then again, if this deadly new organism was named after Frank Murphy, thereby making him famous. . . .

Stop it! I won't get to the Moon that way.

Oh, no? his conscience asked cynically. It won't do Elmo any good for you to do the sackcloth-and-ashes bit. Besides, Petrovich will want to share the credit. . . .

They checked the barn—full of copper tubing and other paraphernalia—and then the deputy knocked on the door of the shack. When there was no answer, he opened it.

They found Elmo in the bedroom on a grimy corn-shuck mattress. His eyelashes were crusted shut, there were whitish patches in his mouth, and he was breathing in deep, labored moans. Spot huddled by his side, beady black eyes following Frank's every move.

Alex glanced at Frank. "Best we take him to the hospital ourselves, yes?"

"Yes," Frank agreed lamely. "Um, what shall we do about Spot?"

"I guess you'll have to take him with you," Atwater shrugged. He was wearing a mask now, too, along with a pair of Petrovich's gloves. "I'd take the little fellow myself, but I've got a pair of hunting hounds. They wouldn't get along."

Petrovich leaned down and scratched Spot between the ears. "We can handle it."

The three of them managed to carry Elmo out to the SUV. Spot trotted meekly at their heels, as if understanding for once that other humans were trying to help.

Once they had both man and raccoon situated in the back seat, Atwater sensibly elected to walk the quarter-mile back to Hillman's place.

Petrovich lifted his head, his shaggy white hair fluttering in the breeze. "Notice how the breeze comes from where he is going?"

"Yeah." Frank wondered if spores were already sprouting in his lungs. He'd seen a really bad Japanese movie once where a group of Japanese fisherman sailed to a strange island, and were all turned into mushrooms.

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If conventional antifungals didn't work—assuming this was indeed a mold, a member of the family of fungi—maybe Alyssa could help him figure out an alternative strategy.

In terms of both miles and time, it was a short drive back to the hospital, particularly with a sheriff's department cruiser racing ahead, lights on and sirens screaming. Perversely, Frank's imagination insisted on manufacturing images of Elmo covered in long tendrils, reaching for the back of his neck. . . .

It seemed to take *forever* before they turned into the Ozark Mountains Hospital parking lot and pulled up in front of the Emergency Room.

A blue-masked and gowned Gigantopithecine appeared in the center of the sliding doors. Frank recognized Elvis Wong, the nurse on duty. A hand as big as a suture tray swung forward to open Petrovich's door; the other rolled the gurney to a stop beside the SUV. "Alex, ol' buddy," Wong said in his West Texas drawl, "I'm just as sorry as can be to hear about ol' Dan. I stuck him seven times to get a line in once, and he never complained. Cracked jokes the whole dang time."

"Yes, that sounds like him."

"OK, boys, let's get our Mr. Hackleford inside. Frank, you got his shoulders?"

"Right."

"One, two, three, heave. . . ."

Frank lost track of time over the next several hours: with Elvis and Petrovich, he wheeled Elmo into the isolation room, started his IV fluids, gave Spot a package of graham crackers and a towel to sleep on, performed a bronchoscopy to obtain a sputum sample for testing, made phone calls back and forth to Lab, Respiratory Therapy, and the pharmacist, Elvis's wife Kathy. . . . Thankfully, she came in and prepared maximum doses of standard antifungal drugs, so he didn't have to do it.

Frank's worry that the staff would be fearful of catching the "Ozarks flu," as they had already nicknamed it, turned out to be unfounded. Keithetta, the usually grouchy night nurse, did not exactly turn into an angel of mercy, but she was available whenever he needed a hand, and making fresh coffee when he didn't. Wong took Elmo's vital signs every ten minutes, his big hands gentle as butterflies; in between vitals he called Elmo's relatives, and helped Petrovich deal with a reporter from *Ozark Mountains Daily News*.

Frank longed for an intensive care unit. An isolation room with one old telemetry machine—which occasionally registered a heartbeat when no one was there—wasn't enough for someone as sick as Elmo. He needed a ventilator in case he stopped breathing. But the CDC, hypercautious since the big California plague scare, had refused permission to AirEvac him out.

Finally, at a quarter after midnight, Alex shooed Frank out of the room, ordering him to "eat dinner, or I stick a tube down your throat!"

Frank sat down at his desk with a cup of coffee, a hunk of Sherri Lynn's leftover molasses bread, and two microwaved Circle K turkey enchiladas whose labels proclaimed them to be "65% real turkey, enriched with 100% pure recombinant protein manufactured from FDA-approved tobacco plants."

They *couldn't* be any worse than frozen breaded "chicken fingers."

Wolfing down the tasteless enchiladas while downloading his e-mail, he then sent Alyssa a message, telling her as concisely as he could everything that had happened.

He took a tentative bite of the molasses bread. Extremely chewy, but flavorful. Hunger tended to lower one's standards severely, but it just might be possible that Sherri Lynn's culinary skills were improving.

A message from Alyssa appeared on the screen:

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To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

Sounds to me like your plant has a parasitic mold—my guess is the infamous 'Mycojuana,' AKA 'Millennium Paraquat,' on which your government has spent so many millions in hopes that it will destroy the domestic marijuana crop, thus skyrocketing the price of foreign . . . sorry, I digress. I thought they'd select one incapable of gaining a foothold in humans, but one never knows, does one? Your patient's symptoms are similar to Arizona's so-called 'valley fever,' coccidiomycosis, a mold which invades the lungs, gives a pneumonialike syndrome, and in the immunodeficient, can pop out on the skin and invade the brain.

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Nasty Stuff

We thought so too, which is why we placed him on the max-dose drug regimen for valley fever. What do you mean, my government's behind this? That sounds absurdly paranoid.
—Frank

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

They've been working on it since the nineties, according to the story I read on it in the _New York Times_—hardly a paranoid publication. Where have *you* been?

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Nasty Stuff

Interning. You think I have time to read the news?
—Frank

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

No, but maybe you ought to <make> time, sweetheart. Unfortunately, you still live there. BTW, I've never heard of anything that grows as fast as this organism apparently does. Did you do any cellblock slides with fungal stains?

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Nasty Stuff

Yes. Wonder of wonders, our newly donated microscope has a frame capture interface. I'll attach images to the end of this message. If conventional therapy doesn't work, I'm thinking about using biots. Can you help me there?
—Frank

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

Let's wait and see what the images show. I honestly can't say if I'll be able to help you. We don't have biots lying around the myco lab. They're strictly the property of the folks in _de novo_ biosystems.

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Nasty Stuff

A smile like yours could sell snow futures to Eskimos. Just don't tell the guys about the stinkhorns, OK?
—Frank

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To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

Go on with your flattery. If by some miracle I did manage to talk one of our resident experts into programming a batch, *and* he had the time, *and* they came out right, I still don't think you'd be <allowed> to employ them.

To: amarcello@myco.uvic.ca
From: fmurphy@showmenet.net
Subject: Nasty Stuff

As long as we have a signed consent and a prescription, it's perfectly legal. America has long had compassionate-use protocols for the desperately ill. I hate to be redundant, but a man's life is at stake.
—Frank

To: fmurphy@showmenet.net
From: amarcello@myco.uvic.ca
Subject: Nasty Stuff

I know. Just remember, there's many a slip between the _de jure_ and _de facto_.

The images bounced for some reason, so Frank dug up Alyssa's fax number from an old letterhead and faxed them to her. Then he went home and crashed.

The giant red-and-white mushroom chasing Frank around the Moon vanished into the cosmos at the insistent beeping of a satellite, which abruptly transformed into his wrist alarm. He reached for it without opening his eyes and obtained a handful of fur and teeth.

"Yeeow!" He shot up in bed, clutching his wounded hand. On the nightstand, Spot blinked and sat up, the much-chewed wristwatch hanging from his mouth.

"Give that back, you fur-faced fleabearer!" Frank lunged for the watch, but Spot hopped nimbly off the nightstand and raced out the bedroom door. Cursing, Frank jumped out of bed and immediately tripped over the adjustable dumbbell set he'd received for Christmas.

Don't be an idiot, Murphy. If you corner an animal of that size, you'll end up with worse than barked shins and a nip.

He picked himself up and went into the tiny bathroom to wash and bandage his hand. By the time he'd finished his shower and pulled on Jockey shorts, scrubs, and running shoes, he was feeling considerably calmer.

Until he walked into the kitchen.

Paper plates on the floor, medical books, papers, and journal articles strewn to the four winds. On the wooden table, a few crumbs and bits of mangled cardboard—the remains of half a loaf of bread, a banana, and a new box of Heart Up cereal, the quinoa-soy mix for the healthy heart. Among those remains were others already processed through the raccoon's digestive system.

Spot sat amid the carnage, cheerfully gnawing on the telephone cord and clutching the wristwatch.

Frank debated chucking the little monster out. "Out, out, damn. . . ."

But Spot wouldn't leave Elmo. And it was Frank's fault Elmo was in the hospital.

Growling under his breath, Frank grabbed a can of tuna, opened it and set it on the floor. Spot lifted his head and sniffed. Frank filled a bowl with water and set it next to the tuna. Spot scampered over and dropped the watch. Daintily, he washed his paws. As soon as he began stuffing himself with tuna, Frank leaned down and picked up his watch.

"Cripes, look at the time!" He strapped on the dented timepiece and sprinted for the door—minus coffee and cereal, but at least on time for clinic.

His first patient, Mrs. Waldenhof, was a cancellation, so he ducked into his of-

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fice and called Petrovich at the hospital. "How's Elmo ?"

"Well, he has now two doses of the synthetic triazole and he is no better." Petrovich sounded hoarse, no doubt from lack of sleep. "His O_2 sats dropped eight percent, so I put him on oxygen, two liters a minute. He is breathing easier, but with zero signs of regaining consciousness. I add a couple of broad-spectrum antibiotics, just in case he's got hitchhiking bugs on board, and our wholesaler is shipping us a case of Fungo-Gone, which I don't want to use because it will probably nuke his overworked liver. But it appears we are stuck with it."

"Any Histo results yet?"

"Yes. It is a mold, a fungal species unknown to BioMedex. The spore proteins match those in Elmo's blood and sputum."

"I've got a theory about that." Sitting down on the edge of his desk, Frank repeated Alyssa's suspicions about 'Mycojuana'. "If she's right, the authorities have a lot to answer for. They've no right to introduce a *de novo* pathogen without proper testing."

"I am thinking the same thought as your friend as soon as I see this thing. I am also thinking what happens to the bearers of bad news."

"If it's hugely bad news, they get an interview on CNN and a book contract. This is huge. Any prelims on the autopsy yet?"

"No, they will call about noon. Hal Kenyon's on it, and he's usually pretty fast."

"And the CDC?"

"They have somebody flying into St. Louis, arriving about eleven-thirty. Assuming she has no trouble with my directions, she will get here around three."

"Shouldn't we send someone to pick her up?"

"I suggested. She insists driving herself."

"Well, at least the roads are good this time of year. Maybe we'll take her out to. . . ."

"Forget it, Frank. They kept saying she will have this all sorted out in an hour or so. The question is, who will get here first—her or FIG?"

Frank hoped Alex was kidding. Of course the feds were going to be embarrassed that they'd dumped the spores without performing adequate safety tests. But after all the stupid things they'd done in recent years, they ought to be immune to embarrassment. Surely they wouldn't bother sending the Federal Investigations Group all the way out here, to little Ozark Mountains Hospital. This was a medical issue first, a legal one second.

Nevertheless, Frank felt a penumbra of depression shadow his personal landscape as he hung up. FIG was quite capable of making life miserable for whistle blowers, particularly a couple of unknown doctors in Podunksville, U.S.A. If, by some wild quirk of fate, he and Petrovich happened to be the first to report this syndrome, things could get hairy fast. All he needed was one black mark on his record to discredit him with the Artemis folks.

Sherri Lynn came in, carrying a stack of mail, a cup of steaming coffee and a slab of something that looked as if it had been airlifted from the Petrified Forest. Her pink scrubs did about as much to conceal her figure as that silly towel in "Venus on the Half-Shell," or whatever that picture was called, and her beautiful eyes were red-rimmed, as if she'd been crying. "Good morning, Dr. Murphy. I thought you might be hungry, so I brought you some coffee and pumpkin bread."

Frank smiled nervously; his gaze dropping to the stack of professional journals on his desk which bore such riveting titles as "Meeting Criteria for Colonoscopy: New Federal Guidelines." "That's very thoughtful of you, Sherri Lynn. The coffee smells great."

She set the coffee on his desk with

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the pumpkin bread and plopped the mail in his in-basket. "Oh, it's just so awful what happened to poor Mr. Hillman! Seems like it's always the good who suffer." She took a Kleenex from her pocket and blew her nose loudly. "The trials of Job all over again. And now the Hackleford family."

"Uh-huh." Frank sipped his coffee. The only safe way to respond to comments like that was to stick to neutralities. He wondered where Spot had run off to.

"That nice Deputy Atwater came by and said he needed to speak with you."

Frank almost choked on his coffee. "He did? What about?"

"He didn't go into details, just said for you to call him. Oh, and Ms. Oglethorpe's here. She wants to see you right away. She wouldn't say why."

Frank reached for the phone, resolved to call Atwater despite the formidable Ms. Oglethorpe, when a creak in the floorboards made him look up, past Sherri Lynn's rounded bottom—she had turned also, to look at the man in the doorway.

The man stepped inside without knocking, a ray of sunlight from the window glinting on his bright green eyes and bald head. His thick black eyebrows and jutting nose gave him a formidable look; he was one of those rare men who maintain their physical prime well into their fifties. His sharply tailored silver-gray three-piece suit fit his short, athletic frame like a steel jacket fits a torpedo.

New York, Frank thought, with the habitual amusement of the Southern Californian toward inhabitants of the northeast coast, who seemed to dress for winter every day of the year. The idiot would be sweating like mad in another hour.

"Are you Dr. Frank Xavier Murphy?" The green eyes were unsmiling; the voice boomed out with the ear-throbbing baritone resonance of a drill sergeant who has sung opera. The accent was definitely New York.

"Yes." Frank hid his irritation at this peremptory invasion of his office. "Who are you?"

"Lieutenant Tolson. I'd like to ask you a few questions." He glanced pointedly at Sherri Lynn. "Alone, please."

Wide-eyed, Sherri Lynn exited, her green scrunchie bobbing among her strawberry-blonde curls.

"I've a patient waiting, but I suppose I can give you a minute. May I see some ID?"

Tolson flipped open his wallet. The red-and-white smart card had *Federal Investigations Group* embossed on it in twenty-point blue type, and beneath that, in smaller type *J. Gordon Tolson, Investigator*. In the upper right-hand corner was a holo of his face bearing a fearsome smile. The embedded chip no doubt contained his retina-print as well as his thumbprint.

Frank decided against having the card scanned; Tolson was obviously who he claimed to be. "Have a seat. Now, what's all this about?"

Tolson remained standing. "Dr. Murphy, what's the extent of your involvement in the medical marijuana movement?"

Before Frank could answer, Ms. Oglethorpe grunted her ponderous way into the office. "*There* you are, Dr. Murphy! Didn't that girl of yours tell you I needed to see you right away? My husband and I—he's the hospital director, you know—saw a breakthrough medication advertised on TV last night called Slimillennium, which you may not be aware of yet on account of it's so new. It's a totally unique fat-blocker. . . ."

Frank's fingers clenched on the arm of his chair. "I'm sorry, Ms. Oglethorpe, but I have someone in here. If you could hang on for just a moment. . . ."

"Oh!" She glanced at Tolson in surprise—the existence of others always seemed a shock to her, as if she were the only star and everyone else dark matter. "Well, I suppose so." She gathered her dignity about her and huffed out.

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Frank forced himself to smile. "The answer to your question, Lt. Tolson, is zero. You still haven't told me what this is all about."

"Dr. Murphy, I am empowered by the U.S. government to investigate matters of national security. Now, it looks to me like you have a pretty cozy setup here. Nice office, sweet little secretary. . . ."

"She's not my secretary, she's the nursing assistant." Frank looked at his watch. "Lt. Tolson, will you please get to the point?"

"I'll be happy to. I understand that you and Dr. Petrovich have two patients, one alive, one deceased, whom you believe to be infested with a species of fungus, known in vulgar parlance as 'Mycojuana.' And furthermore, that you two believe this fungus to be responsible for their condition."

"It's a hypothesis. We are still investigating."

"What evidence do you have for this fantastic claim?"

"That is confidential patient information."

"So confidential, you had no qualms about e-mailing it to your Canadian friend last night. *Is* she a friend, or someone a bit more intimate?"

Frank couldn't believe this. "My relationships, professional and otherwise, are none of your business. Since you read my e-mail, you must know that I did not supply her with either patient's name. Therefore, there has been no breach of confidentiality. I would be surprised if *you* don't already know the names of these patients."

Amusement lit Tolson's green eyes. "'Confidentiality' doesn't apply to an officer of the federal government. Any information with implications for the welfare of the American people is under our purview. Perhaps unwittingly, Dr. Murphy, you have made accusations and solicited a course of action that represent a danger to this country. Do you care about the future of America, sir?"

Frank thought that the future he cared about was one where the *idea* of America was carried on elsewhere, since it had succumbed to its own version of "victory disease" here at home. But he doubted he could explain that to the lieutenant. "Of course I do."

"Then perhaps you should pay attention to the fact that this country is fighting for its life. Our men and women in uniform are sacrificing their lives to fight the Pan-Asian threat, and they need our support at home. Our armed forces don't have the manpower they need on the battlefield because the pernicious rot of drug addiction has swept through our young like the plague. The last thing they need is for people here at home to be encouraging drug abuse."

Frank's systolic blood pressure spiked twenty points. "Is that how you characterize treating a sick old man? 'Encouraging drug abuse'? "

"Your allegations, sir, are aimed directly at the heart of our eradication program. That's undeniable. Nor should you imagine that you will be allowed to bring unnatural organisms like biological robots into this country. They're a threat to our precious natural resources. As a doctor, you should understand that."

"Biots are no threat to natural resources. When they run out of the food they're programmed to eat, they die. Furthermore. . . ."

Tolson smiled and shook his head. "Neither of us has time for pointless argument, Dr. Murphy. I suggest you cooperate . . . unless you want to become familiar with the term 'obstruction of justice.'" The green eyes made a trip around the office as if pricing and cataloguing everything from the rolltop desk to Frank's orange and green toucan-patterned scrub shirt.

With horror, Frank suddenly remembered what he'd done with the Xerox of Elmo's slides after he faxed it to Alyssa. He'd thrown it in the To-Be-Shredded box, which sat on the floor to the right of the doorway. Was it face up or face

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down?

". . . don't expect your propaganda piece at *Ozark Mountains Daily News* to attract any attention. The story won't be printed."

Face down—probably. But you couldn't miss the box, and if he looked in there, it'd be the first thing he'd find. He'd know immediately what Frank had done. What Tolson would do then, Frank couldn't guess, but he had a feeling it would be unpleasant.

Tolson couldn't *arrest* him for faxing anonymous slides, could he? Surely not. Surely. . . .

Frank swallowed lukewarm coffee, hoping it would keep his voice from cracking. "We're not trying to destroy this country, lose the war, or promote drug abuse. We're just trying to save a sick old man."

The FIG man snorted. "Spare me the sanctimonious cant, Murphy. 'Medical marijuana' is simply a back-door gambit for legalizing weed. It didn't fly twenty years ago, and it doesn't fly now. Paranoid accusations about the eradication program are par for the agenda."

Frank would have laughed right then if he'd been capable of it. His drug of choice was single-malt whiskey, and he'd never so much as written a letter in favor of medical marijuana. Not even when his own father was dying of lymphoma.

Frank the med student had thought it a waste of time. After all, reams of scientific studies proving that pot caused the munchies had gotten nowhere, ditto medical marijuana initiatives that "won" by overwhelming majorities. Now that he was being tarred with the beast-slouching-toward-Bethlehem brush, he wished he deserved it.

"Don't get any wild ideas about contacting other newspapers. There's a federal law against terrorizing the public." Tolson glanced at the To-Be-Shredded box. "What's in there?"

"That's scrap paper for recycling." Frank realized that his hands were trembling, and carefully set the coffee cup back down on his desk. *Terrorizing the public?* If he's so sure the mold is harmless, why is he afraid to have it questioned? What's wrong with subjecting it to proof?

Frank heard an odd clicking-scraping in the corridor. Spot slid through the doorway like the lead skater in a small-mammal roller derby just as Tolson took a stride toward the box. Evidently the raccoon wasn't looking where he was going—he thunked his solid little head square on the man's shinbone.

The FIG man grabbed his leg and swore, using a couple of words Frank didn't think were in his lexicon. "What's this you've got running around your clinic—a wild animal?"

Apparently sensing hostility, Spot hid under Frank's desk.

"Oh, no—he's quite tame!"

"In that case, I'm reporting you to Fish & Wildlife for removing a wild creature from its habitat. I warn you, if that thing comes near me again, I'll shoot it on sight." Tolson stomped out.

Shaking with adrenaline, Frank leaned down and petted the raccoon. "A real friend to animals, huh?" He yearned to race over to the box and chew up the Xerox—him or Spot, it didn't matter. But if the FIG agent decided for some reason to come back right away . . . Frank shuddered.

It occurred to him that perhaps he should try calling Tolson's supervisor to complain. Except that his views would come as no surprise—they were probably a job requirement.

So FIG had been lurking on-line, reading his e-mail? The smart thing to do would be to phone a really big newspaper, such as the *New York Times*, and blow this whole thing wide open. Once that happened, other doctors would come forward. These *couldn't* be the only two cases. But he'd need to have his ducks lined up, with all the data available for scrutiny. Otherwise he and Petrovich would look like kooks, and

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the whole thing would die. Frank's reputation would be irrevocably tarnished, and he could kiss his chances with Artemis good-bye.

He retrieved the incriminating Xerox and tore it to tiny shreds. Why risk everything for an old moonshiner? Why not keep his head down and play ball with FIG? There was no guarantee that other doctors would come forward, and if the CDC decided to sit on their data, they'd be up the proverbial creek without a paddle.

Ms. Oglethorpe invaded the office again, forcing Frank's thoughts back to the present. As soon as she departed, triumphantly clutching her script for Slimillennium—Frank felt like such a whore—he called Deputy Atwater. "Deputy, this is Frank Murphy. What's up?"

"Got a call from FIG at five this morning. Seems like your folks at the CDC rung them up last night."

"I figured as much." Frank related the bare facts of Tolson's visit. In case the phone was tapped, he took care not to embellish his account, or allude to Atwater's knowledge of Hillman and his marijuana plant.

"All that happened this morning, you say? Speaking as an American citizen, I'm glad to hear that our FIG is responding in such a timely fashion. I'm sorry to hear that he mischaracterized your position, but I'm sure it will all be cleared up soon."

Definitely tapped.

Scowling, Frank thanked him and hung up. The phone rang almost immediately.

A tired voice said, "Frank Murphy?"

"Yes?"

"This is Randall Oglethorpe. How are you?"

Great. Now the hospital director's on my case. "Oh—hi, Mr. Oglethorpe—I didn't recognize your voice at first. I'm fine, how are you?"

"Fine and dandy. I understand you spoke with Lieutenant Tolson this morning."

"Yes, just a few minutes ago."

"Well, I want to make sure that everyone here understands the importance of cooperating with him. *Full* cooperation, nothing halfway. Furthermore, it is our policy that our doctors use *only standard medical practice* to treat the sick. This hospital is not licensed for experimental treatments, and does not need to be pushing the envelope, controversy-wise. Do we understand each other?"

"Yes, sir." Frank doubted very much whether vice versa applied, but he certainly understood Oglethorpe. Loud and clear. The director said good-bye and Frank hung up, wishing he'd never heard of Elmo Hackleford or Dan Hillman.

In between clinic patients, Frank reacquainted himself with his old biology text. Bacteria were prokaryotes—their cells lacked a true nucleus, and the cell walls could be targeted and destroyed by antibiotics. But humans and fungi were both eukaryotes; DNA studies showed that humans and fungi had a more recent common ancestor than did fungi and plants! So far, no one had found a way to kill fungal cells without harming human cells. The more Frank thought about it, the more he thought biots were the solution. They were uniquely targetable. But so far as he was able to determine from an on-line search, they had only been used to destroy cancer cells (which, incidentally, they did extraordinarily well).

Lunch time rolled around, but he was too wound up to eat. Or perhaps it was only the pumpkin bread weighing down his stomach. He didn't want to e-mail anyone so long as Tolson was lurking, and there was little point in warning Alyssa about FIG. The agency couldn't do anything to her, and it would make him look guilty. That would not help Alex, either.

Hands in his pockets, Frank walked across the dirt parking lot to the hospital. The damp, oppressive August heat

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sticking his shirt to his back was a perfect metaphor for the state of his soul. He was afraid of running into Tolson, and despised himself for it, but most of all, he couldn't stand the info deficit any longer. Petrovich must've heard the preliminary autopsy results by now.

Elvis Wong sat at the nursing station desk with his feet up, reading the *Fort Worth Star Telegram*, a blue Cardiac Thumpers Team baseball cap sitting low on his forehead.

"Hey, Elvis. Everything going okay?"

Elvis lowered his newspaper. "Just dandy. 'Cept for Elmo bein' a train wreck, but I expect you know all about that. Ladonna's in with him right now; Alex is around here somewhere."

"Thanks." Frank hunted for the chart without success. The nurse probably had it in the room with her.

Elvis's dark Asian eyes studied him. "We'll find a way through this, bud, but you got to have faith. You hear what I'm tellin' you, Frank boy?"

"Uh-huh." Frank wondered if he meant faith in God or the rightness of what they were doing, or the kind Sherri Lynn had when she danced with poisonous snakes. Try as he might, Frank couldn't picture Elvis in that church. The mind boggled.

"Good." Elvis went back to his paper.

Frank found Alex talking to a crowd of more than a dozen people outside the old moonshiner's room, ranging in age from a gangly woman in her fifties to a toddler just able to walk. All were clad in clean overalls; the adults had the walnut-grained patina of those who earn their living outdoors.

"...no visitors," Petrovich was saying. "If he coughs while another person is inside, that other person could breathe in the spores and become ill."

The rangy woman nodded. "OK. It was a nice idea, kids, but I don't want nobody else sick. Let's all get out of Doc Pete's way, and let him do his job."

"Hold up a minute!" a scruffy bearded man objected. "There's some kind of cover-up goin' on, and we oughta...."

"Oh, shut up, Bufe!" the woman snapped. "Anyone could hide something from you by writing it in plain English. Let's go." She began herding them out the door—all except for a small child of about six, who ran up to Petrovich and tugged on his sleeve.

"Please don't let my grand-daddy die! If he does, we'll have to bury him in a cardboard box in the garden, like my goldfish."

"I will try very hard not to let that happen," the Russian said seriously. He looked very tired, and Frank noticed that he was wearing blue scrubs instead of his usual cowboy clothes. He must have stayed all night—probably slept in the change room.

When the family had gone, he and Frank donned gowns, gloves, booties, head-coverings, and masks to look in on Elmo, who in his nest of IV lines and catheter tubes seemed about to be devoured by a giant Viaflex spider. His skin was the color of old piano keys, his bepurpled nails layered in white spores, the texture of velvet on deer antlers.

Ladonna, his nurse, sat at a desk nearby, writing progress notes in the chart and humming. Bouffant Clairol-red hair, swelling her white head-covering like lava erupting from Mt. St. Helens, made her instantly identifiable despite her mask and gown.

Frank peeled open one of Elmo's eyelids. The sclera were sulfasalazine-yellow, the battle-flag of failing organs. "Wow. Let me guess—liver *and* kidneys circling the drain."

"Bull's-eye. That is from two doses of the triazole and one dose of Fungo-Gone. There's no way we can save him, Frank. Not with conventional therapy."

"What'd the autopsy prelims show?"

"Dan expired from an unknown systemic mycosis, specifically fungal infestation of the lungs complicated by hypoxia, acid-base abnormalities, pulmonary edema and fungal growth in the central nervous system and epider-

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mis. The causative organism is identical to that found in Elmo. My guess is that they cloned the stuff in vats, scraped off a few tons of spores, and sprayed them from crop-duster planes."

That paralleled Frank's thoughts. "Did you get anything in school about the discovery of endogenous marijuanalike compounds in the brain?"

"No, but I have read of them—a study of Huntington's chorea, I think. Apparently they're involved in volitional movement and other activities. Perhaps the mold set up housekeeping on these compounds, yes?"

"Could be."

"If so, that means that even if the Fungo-Gone weren't killing Elmo, it still cannot save him, because the drug won't cross the blood-brain barrier."

Frank watched Ladonna walk out of the room. "There might still be a way."

"How is that?"

"Biological robots."

"The new synthetic pseudo-bacteria?"

"Right. I have a mycologist friend who's interested in this. With the microscopic images I sent her, a biot specialist could layer the spore configuration into a biot food recognition program. Then they clone a few thousand biots, which they overnight to us in a fancy kind of yeast—the biots use it as a metabolic substrate. Then we pop 'em into Elmo and let 'em go into a feeding frenzy."

Alex's eyebrows elevated. "There are more barriers to this than lie between the blood and the brain."

"Oglethorpe can't tell us how to treat our patients. He's not a doctor; that's practicing medicine without a license."

"Frank, these biots are not legal here."

"Yet. Anyway, the FDA put out rules about 'compassionate use exceptions' for unapproved drugs more than twenty years ago."

"That is true. But they routinely violate them. Some patients have meds legal in other countries shipped here, no trouble. Others are arrested for doing the same thing, their meds confiscated—but of course the charges are always for something else. This J. Gordon Tolson character . . . you have met him?"

Frank nodded. "He's a hard case all right, but he can't stop us from medicating someone whose only option is death. Anyway, biots aren't illicit substances."

"No, but they might escape into the biosphere. What happens to the War on Drugs if biots programmed to eat these spores are suddenly loose?"

Elmo coughed noisily. Even with the mask on, Frank felt an impulse to hold his breath. "Well, I guess I'm stupid. I didn't think of that. But if this 'Mycojuana' is killing people with weak immunity, then that's a bonus."

"It also means," Petrovich added, his blue eyes bright over his mask, "that there is a lot more than just one old man at stake. Or a hundred of them, for that matter. It is the entire metastasized bureaucracy of drug warriordom."

"Alex. . . ."

"No, you listen to me. I lived in Soviet Russia until I was twenty years old, for four years after World War II. I saw what happens when government determines to save people from themselves. Good people, who mean well, I am not being sarcastic . . . and they committed so many wrongs, it makes the soul shudder. And it corrupted them, until millions died, and still they would swear it was all justified by their good intentions. You do this thing, I am with you all the way. But you must have your eyes wide open."

Elvis's voice reverberated on the overhead intercom: "Dr. Petrovich, Dr. Murphy, please report to the nursing station."

"Hey, must be important if he's calling us both 'doctor,'" Frank said with a smile, trying to dispel the tension.

Exiting Elmo's room via the "air-lock room," they peeled off their protective coverings and threw them in the Bio trash. Outside, they found a fiftyish

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woman in a trim gray business suit standing in front of the nursing station. Her hair was a fine baby-blonde, a popular look among aging Boomers, done in an earlobe-length bob, and she had a slim, toned look—the kind of woman Frank used to see in the gym in Anaheim whenever he went to work out.

Shifting her metal briefcase to her left hand, she extended her right to Petrovich. "Hello, I'm Dr. Babbs from the CDC. And you are?"

"Dr. Alexander Petrovich. And this is my colleague, Dr. Frank Murphy."

Her brief smile and minimalist handshake made Frank wonder if she were on a pleasantry budget. He disliked her already. "Hi. Nice to meet you."

"Did you have any trouble finding the place?" Petrovich asked.

"No. Well, I drove right through that quaint little town back there before I realized it, but other than that. . . ." She waved a pink-nailed hand, as if to say that anyone might have made such a mistake. Her silver war bracelet flashed in the light, the soldier charms making a sound like tiny bells.

Alex nodded. "Would you like something to eat? Ruby's Cafe is right. . . ."

"No, I don't care for anything. If you would just show me the charts and the biological samples, I'll get right to work."

Frank took her down to Lab, where he signed for the samples. June, the phlebotomist on duty, gave him the slides from Cytology, took the blood and sputum plates out of the incubator, then removed sample 26557334IH from the locked freezer.

Frank frowned down at the plastic-encased leaves. "They look different, somehow."

June shrugged. "Freezing makes them look darker."

"These aren't the same. . . ." Frank glanced up at her. "Was that federal agent in here this morning?"

"Federal agent?" June looked frightened. "Is the hospital in trouble? I thought we passed our State Board inspection with flying colors."

"No, no, it's nothing to do with the State Board."

Dr. Babbs was looking more and more annoyed. "What's the problem, Dr. Murphy? Are you suggesting that an officer of the law might have altered evidence?"

Frank stared numbly at the blood and sputum plates, which displayed no sign of yesterday's massive overgrowth. The slides showed nothing but cellblock and seaweed agar. His shoulders slumped. Obviously Tolson had gotten Oglethorpe to let him in here before the shift started, which was probably why the director had sounded so tired this morning. The lieutenant was a professional—he wouldn't come waltzing in during business hours. You really had to admire the neat job he did on the evidence bag seals. "Oh, no, not at all."

Dr. Babbs gave him a frigid look. "Then I fail to understand the point of your comments."

"Sorry. And now if you'll excuse me, I've got to get back to my patients. See you around, Dr. Babbs." Frank strode out, not waiting for her reply.

The afternoon lingered, like a bad cold. About a quarter to five, Frank called Petrovich, and asked him if he'd like to eat dinner with him at Ruby's.

"Sure. But has to be quick. I must crash for a few hours, or I will be worth nothing tonight."

"I'll take your shift tonight. Don't worry about it. Meet you at Ruby's in fifteen minutes."

"Thank you. See you there."

Twenty minutes later, Frank was seated in the cafe beneath a lethargically revolving fan, munching a piece of candied watermelon and wishing he hadn't said he'd work—a couple of tall cold ones would be welcome right now—when he saw a dark-green and chrome-steel sedan, one of the newer gasoline-electric hybrids with medium armor, bumping its way across the rutted hos-

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pital parking lot. It pulled out onto the pavement, then roared off down the road toward St. Louis, a fog of pale dust swirling in its wake.

The door swung open with a jingle and Petrovich came in, Spot loping at his heels.

Frank handed a piece of melon to the raccoon, who took it between his teeth, jumped up in the booth and curled up in a ray of sunlight, bushy striped tail tucked around his sizable haunches. "Was that Babbs leaving us, without so much as a good-bye? I thought for sure she was going to give me a big hug."

The Russian sat down. His eyes were bleary, and white stubble prickled his cheeks above the trim line of his beard. "Well, she said good-bye to me. Right after she told me that the marijuana sample had no spores on it, and ditto for the blood and sputum. She says the Ozarks flu must be caused by a virus, and that we are incompetent publicity hounds."

Frank uttered a rude monosyllable and stared out the window. "Yeah, we got *tons* of publicity out of this."

"Anyway, pictures and spore-prints of 'Mycojuana' are unavailable. So, no match, no proof. Is simply weird new syndrome, tests improperly performed."

"Couldn't we FOIA that out of the appropriate agency?"

"Sorry, Freedom of Information Act does not apply to Drug War."

"Stupid of me not to realize that. I suppose the final autopsy results will be totally different from the preliminary, too."

"I do not know about that, but if not, we must find good way to hang onto evidence. Dan's brother called and said he is having him cremated tomorrow."

Frank sighed. "FIG can't keep something like this under wraps."

"I agree. They are desperate to buy time. This kind of exposure would look very bad for current president with the war going on, not to mention election coming up."

The door jingled again as it admitted a bland-looking middle-aged man in a loose-fitting blue suit, who stood looking around uncertainly.

Ruby appeared in the doorway to the kitchen, a plump bottled redhead with rich brown skin and an Avon smile. Something—either the freckles on her nose, or the gap between her front teeth—made her look a decade younger than the claimed "thirty-nine and holding." "Evenin', fellas. You want the special?"

Frank looked at Alex; they both nodded.

"Usual drinks?"

More nods.

"Ozzie, honey, throw a couple of chicken breasts on the grill. No, not them old roosters—the pullets." She grabbed a menu and a glass of water and seated the stranger several booths away from them, then brought Frank a glass of iced tea and Petrovich a glass of goat's milk. With a cheerful, "Be right back, y'all," she vanished back into the kitchen in a swirl of blue gingham.

"Well, so much for calling the *New York Times*," Frank said gloomily. "We've no proof now, no nothing." Where would he find another place so desperate for a doctor that they'd ignore a black mark like this? Unless they inherited a practice or a fortune, *everyone* went to small towns straight out of med school to pay off their tuition through the federal Doctors for America program. He might even be kicked out of the program.

Petrovich got up, put several quarters in the Wurlitzer—a bechromed masterpiece that had seen better centuries—and punched his selection. A wistful male voice began singing: "When We Got Down to Nothin', Nothin' Sure Looked Good on You."

Resuming his seat, Alex spoke in a low voice. "Don't talk foolishness, and for God's sake, keep your voice down. That fellow back there could be on FIG's payroll. Now, we still have Elmo, producing spores like nobody's business,

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and we still have our two brains. I have a friend in Canada. . . ."

Frank listened in amazement as Petrovich explained about his friend in the biot business, and how this friend was going to have specially-programmed biots overnighted to him here at the hospital. "You're *quick*. I've been trying to get something like this moving since last night."

"Believe it or not, Frank, you are not the only one around here with Net friends."

"I guess I hadn't devoted much thought to it," Frank confessed. "But why didn't you tell me about this earlier?"

"Because I know the risks involved. I didn't know if you'd want to go through with it. What you don't know, you can't talk about."

Frank was uncomfortably aware of how close this came to his own self-doubts. "Well, sure I want to go through with it. I just don't see how. Tolson's blocked us at every turn."

"Perhaps." Alex coughed loudly and drank his milk.

"You OK? That sounded pretty bronchial."

"Do not worry, I am in fine health. Anticipating that there would be a privacy problem, my friend and I have been using encryption."

"How'd you manage that?"

"My algorithm encrypts the message inside a high-resolution thirty-two bit photo—camping pictures are handy things. The only problem, of course, was sending the microscopic images of the fungus. Our ISP has been instructed not to send such files."

So that's why it bounced. "Did you fax them, then?"

"Yep. They went to another friend, who sent them on to my friend in Victoria."

Frank paled. "*Your* friend is in Victoria also?"

"Where else can one get what we need?"

"But I faxed the images there, too, so now the FIGgies are going to be on the look-out for a package from Victoria. That's where my friend is—I sent her e-mail asking her to send me some. I don't know that she'll be able to, but. . . ."

"Not a problem. My friend brought it across the strait on the ferry to Port Angeles, so the package will be postmarked from the state of Washington. And it's being sent to Pharmacy, not me personally. In fact, your having a package sent from Victoria will almost assure mine being ignored."

"Oh, right." Frank's spirits lifted. "That ought to work fine!"

Ruby brought their food then, two plates piled high with grilled chicken, mixed vegetables and Ruby's famous spoon bread, plus a small plateful of scraps for Spot. Despite Frank's compulsion to throw suspicious glances out the window, Tolson did not materialize.

Spot polished off his plate and then displayed a new talent—begging for people food. His soulful brown eyes reminded Frank of the Irish setter he'd owned as a boy, a perpetually famished collection of big feet and long hair. Several bites of chicken later, the raccoon fell asleep with his head pillowed against Frank's knee.

Alex's cough worried Frank. He told himself that the old man had been up for thirty-six hours, and could hardly be expected not to show a few signs of wear and tear. It was probably nothing to get excited about.

Petrovich started yawning halfway through the meal, and could hardly keep his eyes open afterwards. When Frank suggested he hit the sack, he didn't put up much of an argument.

After he left, Frank ordered a slice of apple pie and pondered what to do.

Alex had not told Frank *not* to use the phone—simply pointed out that he might as well consider it a party line. But surely that didn't apply to Ruby's phone. This was America, and as much as Frank chafed under its current paranoia, it

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wasn't the old Soviet Russia. Besides, the guy in the blue suit that Alex had been so worried about had already gone.

Leaving Spot peacefully snoring, Frank went over to Ruby's quaint old TwenCen phone booth, closed the door, sat down, and called Alyssa at home. She was probably at school, or in the library, or. . . .

The phone rang twice and then it picked up. Before he could say hello, Alyssa's voice said, "Who are you, and why are you calling me from Missouri, U.S. of A.?"

Those were the words she spoke. Low-timbred for a woman, with ironic emphasis on *why are you*, the voice itself spoke of three-sigma intelligence and that quirkiness that was the essence of Alyssa. He'd forgotten how much he'd loved this voice. If only she wanted to go out into space, like he did, he'd suggest starting over in an instant.

"It's Frank."

"Oh, good. Let me start by telling you that I got your fax. I spoke to Janine Ng and Bill Schweizer about it. . . ."

"*The* Janine Ng and Bill Schweizer? The biot inventors?"

"Right. Anyway, they liked the idea of using biots on fungi, so we put our heads together and came up with something. Mind you, I don't *know* it'll work, because we didn't have a sample to try it out on, but the sims look great. This afternoon I overnighted you enough for two patients."

"Alyssa, I . . . hardly know what to say. This goes above and beyond. . . ." Frank thought of all that skull-sweat going into something that FIG was just going to confiscate and burn. The only good part was that Alyssa, Bill, and Janine were out of FIG's reach.

"My end was easy. An interesting exercise, took less than a day, and as a bonus, we maybe save somebody's life. Who wouldn't want to do that?"

Frank was about to reply—something along the lines of nevertheless, it was wonderful, and BTW, could we redo our agreement about never going out again?—when the door to the phone booth accordioned open. Standing there was the bland fellow in the blue suit.

How rude can a person be? Covering the receiver, Frank said, "There's another phone at the hospi. . . ." The stranger seized him by the left biceps and yanked him bodily from the booth.

"Hey!" Frank exclaimed in bewilderment. The phone wrenched his wrist as it jerked from his clenched hand. His armored car had saved him dozens of times in LA—who'd ever think he'd be mugged in a phone booth in one of the most crime-free parts of the country?

"Caught him in the act, chief," said the blue-suited fellow, retaining his hold on Frank's arm with viselike fingers.

J. Gordon Tolson ambled toward them, a pair of slim headphones arcing over his bald head like a whip antenna on a chrome bumper. "Yes, Charlie, I know." He leaned into the phone and picked up the dangling phone. "Goodbye, Alyssa, my dear." He slammed the phone back in its cradle, clicked a switch on the headphones, and returned his attention to Frank. "Well, Murphy, what have you to say for yourself?"

Frank's heart sank at the sight of Deputy Atwater standing a little behind Tolson, a sheepish look on his handsome face. So much for taking care of our own, eh, deputy?

"That sounds like a loaded question," Frank said slowly. "What's going on? Am I under arrest or something?"

"Oh, my, no. I'm simply detaining you for questioning."

Behind the cash register Ruby and Ozzie the cook were looking at Frank with pitying expressions.

"I insist on speaking to a lawyer," Frank said. That curdling sensation in the pit of his stomach was fear, but he was really angry now, and determined not to be pushed around. "You can't just walk all over people whenever you feel

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like it. I have rights, you know."

Tolson nodded. "In theory you do. Theoretically, you have all the rights your little heart desires. You'll have plenty of time to test this hypothesis. Take him away, Deputy Atwater."

"Yes, sir." The deputy indicated for Frank to hold out his hands, then snapped a pair of steel handcuffs onto his wrists. "Let's go, Dr. Murphy."

All of Frank's fury and humiliation coalesced into a stone of outrage. "Wait just a darn minute here! What are the charges?"

The FIG agent ticked them off on his fingers. "One, soliciting the importation of a biologic agent hazardous to clean air and water, which by definition affects the national security of this United States. Two, conspiracy to do same, which comes under the revised statutes on treason. Three, hindrance of a duly sworn officer in the performance of his lawful duties against the Drug War."

Frank stared at him. "Do you know that anandamide, one of the active ingredients in chocolate, is a cannabinoid? Why not arrest Hershey's and M&M's for destroying America's moral fiber?"

Tolson looked tired. "I'll see you later, Murphy . . . sometime when you're feeling a bit more cooperative. Come along, Charlie." He yanked open the door and flowed out, his henchman gliding in his wake.

"I'm sorry," Atwater said, his eyes mournful. "There's no justice here. But I can't oppose him on this; and it's better I take you in than let him do it."

Frank swallowed an angry retort. Atwater and the sheriff were guilty of fixing crime scenes, and here he was arresting him for a *telephone call*. How could this possibly be happening to Frank Xavier Murphy, *summa cum laude* graduate of UCLA Medical School?

It wasn't *fair*.

Ruby blotted a tear with the corner of her apron. "We'll tell the paper what happened."

"Honey," Ozzie said, "if we do that, we could lose the restaurant."

"Don't worry about it," Frank said numbly. "I'll think of something." To add insult to injury, Spot was still snoring in the booth.

The deputy opened the door and out they went, into the heat and sunlight of the August evening. The trilling birds and crickets seemed to mock him with their hideous cheer. No matter what catastrophes occurred to Frank X. Murphy, the world would go on without him.

Atwater opened the back of the patrol car for Frank. "Mind your head."

Frank threw a last doleful glance to the free world. Across the street was the brown stone church where Sherri Lynn and her snake-dancing friends worshipped. As he watched, a lush strawberry-blonde started up the steps to the church, carrying a square brown basket. "Sherri Lynn!" he shouted.

Her head swiveled around. "Dr. Murphy! Oh, my Lord—what's happened?"

"I'm going to jail—afraid there's no time to explain. Tell Petrovich, and take care of Spot for me, will you? He's at Ruby's."

"All right." She gave the deputy a look that would've ablated NASA's best re-entry tiles. "Deputy Atwater, what's Dr. Murphy's bail? I'm going to take up a collection in church right now and bail him out."

"I am afraid," Deputy Atwater said gravely, "that there is no bail."

Her cheeks turned bright pink. "No bail! I don't believe it."

Atwater seemed to be having trouble meeting her eyes. "If it was up to me, he would not even be arrested."

"I'm sure," she said frostily.

Frank's face burned like a double dose of capsaicin. *You do find out your real friends when you're arrested.* He burst out with: "I love your bread, you know that, Sherri Lynn? All it needs is a bit more yeast."

"Oh, Dr. Murphy, this is just awful! Is there anything else I can do?"

"I can't think of anything."

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"If there is," Atwater said, "I'll call you."

"Thank you, Deputy."

Frank got in the back of the patrol car, the sheriff in front. Off they went to the Kallikak County jail.

The cell was ten feet by ten, which Frank supposed was roomy enough. Big as some of the old exam rooms at the clinic. There was no window, and thankfully, no other prisoners. It was strange how being scanned and fingerprinted made him feel as if he had done something wrong, even though he knew he hadn't.

In an effort to maintain his detachment, Frank watched his blackened left thumb roll across the fingerprint card. He had to stop feeling sorry for himself. Most arrestees didn't get any sympathy from their jailers.

"Dr. Murphy. . . ." Atwater said hesitantly.

"Frank." As long as they were holding hands, they might as well be using first names.

"I'd be pleased if you'd call me Jim. Tell me honestly, Frank: do you think Sherri Lynn could ever be interested in an officer of the law? As a boyfriend, I mean."

"I guess it would depend on how attracted she is."

Jim sighed. "Meaning it's not an honored profession anymore?"

"I don't think I have an unbiased opinion," Frank confessed. "Maybe that's not so important as what you think."

The deputy made a face. "A decent woman would have to overcome a certain squeamishness. Things have changed so much. I. . . ."

The door opened. In walked Sheriff Kinswell with Petrovich.

"I guess this makes us the pair of ruffians," Petrovich said, grinning.

"Christ!" Frank exclaimed. "I can't believe it—they arrested you, too? What's the hospital going to do? Labor Day weekend's coming, and the nearest doctor's a hundred miles away."

"That's what I told Tolson," the sheriff said. "But he says you're a pair of desperate characters. Since the Montana and Idaho sheriff's fight over jurisdiction went belly-up in the Supreme Court, I couldn't exactly order him off my land. Anyway, this's better than spendin' the night handcuffed in the back of his van."

"But the minute they need you two for anything at the hospital," Atwater added, "we're letting you out. Right, Lee?"

"'Course. That's only common sense. Any calls you boys want to make?"

"No," Petrovich said. "I will call my lawyer tomorrow—no sense troubling him at home. I am not calling Dave Oglethorpe. If he wants to rant and rave about the hospital's reputation, he can tell it to my answering machine."

Frank shook his head, wondering if Alex's lawyer would be interested in a two-for-one deal. He wanted to call Alyssa, but he had bothered her enough for one evening. She would probably not appreciate a phone call from an American jail, even on his calling card.

"My wife, Shirley, will make up the bunks," Kinswell said. "You two might as well get some rest."

Shirley appeared a few minutes later bearing clean sheets, pillows, and enough ancillary comforts to stock Army Headquarters. She set up a rotating floor fan, fed them plate-sized turkey sandwiches, and refilled their glasses of iced herbal tea with a Depressionware pitcher that would've commanded an heiress's ransom in an LA antique store.

Alex had delivered both of her children, but unlike most of the clinic Moms, she was less interested in expounding on the virtues of her progeny than in listening to her doctor's troubles. When she had heard the whole sordid story, she turned her face up to the ceiling and said, "Lord, give me strength."

"You've got enough for both of us," Kinswell said.

Shirley pointed a flamingo-pink nail at

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her husband. "Mark my words, Lee, Washington's gone too far. I never put much stock in the Secessionist Movement, but I'm thinking they've been right all along. You and Jim can't stand up to them all by yourselves without gettin' stomped, but if the whole state did, and joined the rest of the West. . . ."

Kinswell massaged his temples. "Honey, you *know* what happened to those sheriffs in Idaho and Montana. Why and how would the state of Missouri want to get involved in this mess? FIG took everything Alex and Frank had for proof."

"Proof? Who cares about that? What you need's publicity. There's got to be other cases like this. Folks need to understand that whatever rights they're worried about losin', whether it's bein' able to defend themselves with a weapon, smoke what grows out of the ground—medication or not—or speak the truth about what's happening, it's all the same thing underneath. Freedom! That's what this is all about. We've got to band together."

"Good luck. Everyone's keeping their heads down, hoping they won't get cut off."

"Well, every movement's got to start somewhere."

"This is one of the reasons we need a space frontier," Frank said.

Kinswell frowned. "I don't follow you."

Frank shrugged. "When the New World opened up, the European monarchs were at first glad to have a place to dump their troublemakers. Then as more and more of their subjects left, and America became a place of serious wealth, they were forced to treat all of their subjects better, or lose the cream of the crop."

Shirley's forehead wrinkled. "But that took *hundreds* of years. I don't think I can wait that long."

"Life happens at a faster pace now. It won't take more than a decade after Moonbase really gets going, I think. Two at most."

She still looked doubtful, but Atwater's face brightened. "Lord Almighty! I never thought the space program could make life better for those of us here on Earth. . . ."

"You still got an uphill battle with men like Tolson," Kinswell said. "You know he told me that if that there marijuana mold ever did kill anybody, they ought to be glad to have a chance to die for this country and the cause o' decency, 'stead of somethin' pointless like a disease. 'Probably the best thing Hillman did in his whole life,' he said."

Frank's eyes widened. "My God! He actually *believes* that?"

"Bet your bottom dollar he does."

"Of course," Alex added judiciously, "he does not believe that humans possess cannabidiol receptors, let alone that anything good could come from them. He is right in saying that many of the medicalizers wanted to legalize for everyone, so he concludes that all the studies showing benefit are lies. Which is *not* true."

"I don't know a 'diol from a hole in the ground," Shirley said. "I believe in decency and I believe in America. But I part company with Tolson—that just ain't right." Her plain middle-aged face creased with determination. "Boys, if you need anything tonight, just holler."

"We will," Petrovich said. "Thank you, dear."

Frank forced a smile. "Yes, thanks, Mrs. Kinswell."

"You're welcome, sonny. I'll get Rita Hackleford on the horn, see what else I can stir up." Kinswell and Atwater followed her out. The clang of the steel door as it shut behind them was the worst sound Frank had ever heard.

Alex turned his back on it. "So, you want the top or the bottom bunk?"

Frank didn't think he was all that tired, but when he stretched out on the top bunk, a wave of exhaustion hit him like a hammer. He stared up at the pebbled ceiling, still unable to believe that

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all this was really happening.

What was he going to do? Of course he'd fight, but with what? He had more debts than assets. Dad's illness had exhausted his estate; Frank couldn't ask Mom to help out; she could barely afford the trailer park in Fresno.

"Frank?" Petrovich's voice floated up from the bottom bunk.

"Yeah?"

"I apologize for dragging you into this. It was not your fight."

"I got myself into it, Alex. Probably for less noble reasons than you did." 'Probably,' ha—certainly. It was guilt over misdiagnosing Elmo.

"Perhaps, perhaps not. I am an old man, it was time for me to make a stand. I have not much to lose. But you are young, with your whole career ahead of you. FIG may decide to drop the charges, but if they do not, where on Earth can you go to escape them?"

"Not Earth—the Moon. And not to get away from FIG so much as everything else—the war, taxes, the tanks in the streets. . . ." Frank sighed. "I know that sounds like running away, but if I start thinking about what I want to run toward—a society of bright, well-educated people with rational goals, pioneers building a future for the human race beyond Earth, beyond beating hell out of the neighbors—well, the difference between that and my reality is so enormous I just . . . feel like crying. I *hate* feeling like that, so I focus on the other stuff."

"Do you still want to go to the Moon?"

"What, are you kidding? Is the Pope Brazilian? But the Artemis folks have to be choosy, they need the best *possible* people to keep their base going. Why look twice at a guy who makes wild charges that can't be substantiated, whether or not he's fighting a legal battle with FIG?"

"I can think of a few reasons. But tell me, why did you become an MD rather than one who flies spaceships?"

"Well, I get nauseated easily, and I was hoping I'd find a cure for it. And two, I didn't think any of these private space companies would make it, so I figured it'd be better to have a career I could earn a living at." Frank studied the pattern of pebbles on the ceiling. "Another dumb decision made in the name of practicality. I seem to have a talent for it."

"Who among us knows the future?" The Russian was silent for a few minutes after that. Presently Frank heard a soft snore, and decided he must have fallen asleep.

Frank shifted his weight on the mattress and closed his eyes. The air was oppressively hot and still this close to the ceiling. He hoped there wasn't a loophole in international law that FIG could use against Alyssa. That would be the pits. He also hoped Spot wasn't giving Sherri Lynn too hard a time. Poor Spot, orphaned twice in two days. . . .

The next thing Frank knew, somebody was shaking him. "Dr. Murphy, wake up! There's been an accident. They need you at the hospital."

Frank stared uncomprehendingly at Kinswell's round face for a full second. The man was wearing a pair of red-check pajamas, and his brown hair was sleep-tousled. Why was he sleeping in . . . Oh, shit.

Frank slid out of the bunk, narrowly missing Petrovich, and grabbed his socks and running shoes. Alex sat on the edge of his bunk, blinking in the harsh light as he pulled on his cowboy boots. "What kind of accident?" Frank asked.

"Two-vehicle roll-over, multiple trauma, at least one level one." Kinswell hustled them outside to his patrol car, which sat in a small pool of light on a concrete driveway. The air was fresh and cool; Frank inhaled a deep, grateful lungfull. Thousands of stars overhead, but the east was green-tinted, dawn-polarized. "The ambulance is approximately eight minutes from the hospital. One of you get in front with me so you can

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talk to ER." The sheriff jumped in and started the engine; Frank waved Alex into the front, then climbed in the back and pulled on his socks and running shoes.

"Who's on duty in ER tonight?" Frank asked, smothering a yawn and glancing at his watch. Jeez, four-thirty in the morning!

"Mabel Heinz." Petrovich waited until they had accelerated out onto the road before asking the sheriff how to use the radio.

Frank sighed. Mabel could certainly do trauma—she'd been an ER nurse for thirty-seven years. But she'd taken an instant dislike to him, and possessed a radarlike ability for zeroing in on anything at which he was less than perfect. There was a fine line between competing for the sake of the patient, and throwing you off your stride completely.

Well, God knows she's probably had to deal with her share of arrogant young docs. Taking a deep breath and telling himself to grow up, Frank leaned forward and focused on the report from the ambulance driver.

" . . . one dead at the scene. We have two level ones, one adult male with a basilar skull fracture and multiple contusions. The other is an adolescent female, concussion, possible fractured skull, fractured right femur, probable femoral arterial bleed. Got a liter of saline in her already, pulse is fifty-seven, pressure sixty-five over forty-two. . . ."

Lights on and siren screaming, Frank and Alex pulled into the ER driveway seconds after the arrival of the ambulance. The sheriff jumped out with them.

Mabel and two other nurses, Laura Lou and Ophelia, were already out there with gurneys, helping the two paramedics, Phil and Chuck, unload the victims.

"When can AirEvac get here?" Alex asked.

Phil shrugged. "Be at least two hours, they said. The choppers are all busy or out of service."

Busy? Christ! Frank sagged against a pillar. If the girl was bleeding out her femoral artery, it had to be taken care of *now*. Which required two surgeons and a full OR staff. The man needed immediate surgery or he'd die from swelling of the brain. How could they possibly take care of both these patients at once?

Alex thumped Frank on the shoulder. "Take a deep breath, buddy. Now let it out."

The breath whistled out of Frank's lungs. "I'm OK."

"I knew you would be. Laura Lou, get on the phone and see if you can round up some other nurses."

The sheriff stepped forward. "Let me do that. No sense wasting her on the phone."

Alex nodded. "Phil, you take the other two patients into Trauma 3; Mabel, you and Ophelia assist Dr. Murphy with the girl; Laura Lou and Chuck, come with me." He vanished into Trauma 1 with the male victim.

"Roger that, Dr. Pete." Mabel was already wheeling the girl into Trauma 2, her short, dumpy legs moving like pistons. "I'll get a second line started, normal saline, if that's okay with you. . . ."

"Yes, sure," Frank said, sprinting after her. "Uh . . . Ophelia, warm up at least four pints of blood. Universal donor, skip type and cross-match. . . .."

Nursing's answer to a perpetual motion machine, Mabel hung more saline and placed sensors for the cardiac and oxygen monitors while Frank scrubbed up. "Dr. Murphy, I'm running both bags wide open and blood-pressure's still dropping. Fifty-eight over thirty-nine . . . fifty over thirty-one. . . ."

Frank pulled on sterile gloves. The girl had the whitest skin he'd seen on anyone short of a corpse, definite arterial bleed. The skull fracture, at least, was only hairline. "Give her an amp of epi IV, one to ten thousand."

"Amp of epi, one to ten thousand." Mabel reached in the crash cart and

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grabbed an Abbject.

"Where's the suture trays?"

"Right there, side shelf." Mabel injected the epi, slammed the needle in the Sharps box.

"Is that blood warm yet?"

Ophelia looked up. "Just one pint. . . ."

"Run it in line one, now." Frank glanced at the monitor as he peeled open the suture tray. Great, pressure's up to seventy-five over fifty. "We're going in. Mabel, I'll need your assistance tying off this vessel. . . ."

All it takes, Frank told himself, *is nerves of steel and gallons of fluid.* That was his last extraneous thought for some time.

When he had finished, and closed her up again, Mabel exhaled and said, "Dr. Murphy, you've got what it takes. In spades."

Phil and Arlene, one of the day nurses, were clapping—Frank vaguely remembered them arriving and assisting with anesthesia. "Thanks. But I couldn't have done it without you."

Mabel's homely face glowed. "Take a break. We'll be okay without you for a few minutes."

"You're a Godsend, you guys. Every one of you!" Grinning, Frank stripped off his gloves and mask, threw them in the Bio trash, and strode out the door. There was nothing like saving the young! Who cared about cutting-edge? This was *real* medicine.

A middle-aged woman hung up the pay phone, grabbed her cane, and hobbled toward him. "Doctor, how is my little girl? Is she all right?"

Frank recognized her as the third victim. She had a pronounced upper-class British accent—tourists, obviously. "Yes, ma'am. She's still recovering from the anesthesia, but you can look in on her if you wish."

"Oh, you dear, dear man!" She hugged him, tears rolling down her face. "I can't thank you enough. My husband, is he . . . is he . . ."

"I don't know, ma'am. Dr. Petrovich is still operating. You can look in Trauma 2, where. . . ." He was speaking to empty air.

Not quite empty enough, Frank thought, as Tolson and his sidekick Charlie came strolling up. Tolson grinned cheerily. "Hiya, Doc. Nice night, ain't it?"

Frank figured he'd come to arrest him again. "Until now."

"My, my, such a tone you take. Afraid I have some bad news. This Hackleford fellow is going to another hospital—one that doesn't participate in the Federal Funds program. The closest is in Bent Knee, Tennessee. They'll be taking him out of here by ground ambulance in about. . . ." Tolson checked his watch. ". . . oh, twenty minutes."

"What! Why?"

"Because, my good doctor, you don't have a legitimate diagnosis code for him."

Frank thought fast. Of course he didn't have a diagnosis code for a new syndrome, any idiot knew that codes had to be *assigned*. "He's an FUO, a fever of unknown origin."

"Sorry, that's not what you wrote in the chart." The smirk on Tolson's face was maddening.

The phone rang; seconds later Mabel poked her head out. "AirEvac's on the way—ETA five minutes." She frowned at Tolson. "Sir, do you have a reason to be in a patient care area?"

"I certainly do."

"And what is that?"

Tolson flashed his badge. "National Security."

Mabel snorted derisively and vanished back into the room.

Frank glanced at the twenty-four hour clock on the wall—0830 already. Another half-hour and the mail would be here. Another fifteen minutes, and biots could be frolicking inside Elmo, chomping down every speck of mold they could find.

"I've figured out what I dislike most

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about you, Tolson," he said. "You are such a lousy liar. You know perfectly well that your mold is killing my patient. By now, you've been deluged with reports about infected people, and I'll bet you haven't dared show them to your own men. Practically everyone has elderly relatives with immunity problems. You must be crazy if you think you can hide all these folks at leper colonies like Bent Knee. That's what the President's worried about, isn't it—the Gray-Haired Vote?"

Charlie's bland face wrinkled. "Say! My mother's in a nursing home."

"You have absolutely nothing to worry about, Charlie." Tolson threw an avuncular arm around Frank's shoulders and walked him off to a corner. "Murphy, I'm going to offer you a deal. Since you're so devoted to this patient, how would you like to go with him? We'll drop all the charges, pay you a competitive salary, and in return, you'll be able to put your knowledge to work on other patients like him." He raised his other hand. "I'm not admitting anything, you understand."

Frank peeled his arm off. "I won't work for you. You're killing the sickest, most helpless people in our society, and you act like it's nothing. I'm not one for conspiracy theories, but it is *incomprehensible* that testing would not have revealed this before your cohorts dumped it all over the landscape."

Tolson's green eyes studied him. "Don't ever say I didn't offer you a fair shake, Murphy. I don't like you any more than you like me."

Frank wished there was some way to *communicate* with this man. It was like they were two different species.

The door to the Fire Stairs opened, revealing Elvis Wong. "Doc, you gotta come upstairs and see what's happened to Elmo!"

"I heard," Frank said wearily. "They're taking him out by ground ambulance. We can't stop. . . ."

"No, that's not it! Come see for yourself!"

Tolson's eyes followed him. "Don't leave the premises, Murphy. You're back in jail the instant your replacement gets here."

Frank walked past Tolson as if he weren't there. Hearing footsteps on the stairs behind him, he turned and saw Alex and Sheriff Kinswell, who'd changed into his uniform. Frank wondered if he kept a spare in the trunk. "How'd it go in there?"

Alex's face crinkled with fatigue. "He will live . . . beyond AirEvac's arrival, at least. Only God knows past that, and He's not telling me."

"You impress the hell out of me, Alex. I hope I have half your stamina when I'm your age."

Petrovich wiggled an eyebrow. "You will have six times as much, running around on the Moon, yes?"

"In my dreams." Frank pushed the door open at the top of the stairs, held it for Alex, then dashed over to Elmo's room and pressed his face against the sliding glass door, trying not to crowd Sherri Lynn and Jim Atwater, who stood nearby with the beaming Elvis. Two strangers in white ambulance-driver uniforms stood apart from the others, examining a clipboard and frowning.

Elmo Hackleford was sitting up in bed, yellower than normal but otherwise alert and healthy-looking, Spot lolling in his lap like an obese kitten.

Frank's jaw dropped. "How in the name of. . . .?"

Elmo squinted at him. "Howdy, City Boy. Pete, tell this hard-headed nurse o' yourn to bring me a glass of tomato juice! This's about the worst hangover I ever had. I may have t'give up drinkin'."

Grinning, Alex shook his head. "Ladonna, bring him some tomato juice. Once he keeps that down, we'll try him on toast."

". . . says right *here* that the patient is supposed to be out of it!" one of the strange ambulance-drivers declared. "Well, he *isn't*. So either we got the

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wrong guy, or they got mixed up at HQ. Either way, I'm not taking him. Let's go."

"OK by me." The other driver followed him out.

"Frank Murphy and Alexander Petrovich!" Tolson said behind them. "You are both under arrest."

Frank turned and saw the muscular FIG agent striding toward them, clutching two oversized envelopes, Charlie flanking him. "As Dad used to say, been there, done that," Frank muttered. "Now all I need is the lousy T-shirt."

Alex leaned against the wall, arms folded, a little Russian smile on his Santa Claus face.

"Sheriff Kinswell, Deputy Atwater, you will now take these men into custody." Tolson opened the envelopes and removed a pair of small plastic jars. "These contain biots, unnatural organisms solicited from foreign agents which can pollute the clean air and water of the great state of Missouri!"

Atwater peered at the jars. "Looks like yeast to me, Mr. Tolson."

"Of course it looks that way to you, you ignorant yokel. Biots are shipped in yeast."

Sherri Lynn smiled. "Funny how it says right on the label, 'Fleur-de-lis Best Yeast.' That's a very popular brand in Canada."

Tolson scowled. "They're biots, I tell you. The analysis will prove it."

Sheriff Kinswell grinned. "You never can tell about these lab analyses, Gordon. And the docs don't seem to be needing these biots, anyway—the patient's already cured."

Tolson stared in the sliding glass door for several seconds, the muscles of his jaw working like a bad case of TMJ. "Not possible. . . ."

"Mr. Hackleford was what we in nursing are pleased to call a therapeutic challenge," Elvis said, drawing himself up to his full height of six foot three. "And by golly, we here at Ozark Mountains Hospital rose to it!"

"Last night's church service didn't hurt either." Sherri Lynn's blue eyes were as earnest as a summer morning. "Never discount the power of prayer, Lt. Tolson."

"This apparent cure, whatever its source, is irrelevant," Tolson snapped. "All I need is an intent to import to convict on conspiracy. And there's still the third felony charge of interfering with my duties."

"Indeed," Atwater said pleasantly. "Allow me to direct your attention out the window."

Frank looked outside. Daylight showed the AirEvac helicopter landing on the lawn, the long grass rippling like water in the prop wash. There seemed to be an inordinate number of cars in the parking lot. And what were all these people with picket signs doing out there? And video cameras?

"All those people with the signs are there because they support Frank and Alex. They say they will not leave until they know what's causing the Ozark Flu. They have sent faxes to the Surgeon General and to reporters from all the major newspapers, asking them to come here and investigate. Quite a few have said yes, including *The London Times*. What do you suppose they'll say about your harassment of these two fine doctors who just saved the lives of a couple of British tourists?"

Tolson exhaled noisily. "What a pathetic lie!"

"Look into it, by all means. Their names are Cynthia and Ken Thorndyke. And don't forget to wave to the cameras."

Frank blinked in surprise, realizing that this was the first he'd heard their names. As he watched, two young men in orange jumpsuits carried Ken Thorndyke on a stretcher into the chopper. Following close behind was the ER staff, wheeling Cynthia on a gurney, Mabel running alongside holding the girl's IV bag aloft to maintain gravity flow.

"Pure extortion," Tolson declared. But he had turned pale.

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Grinning, Sheriff Kinswell pulled out his handcuffs. "Lt. Tolson, I'm arresting you for reckless endangerment and conspiracy to deprive these two men of their Constitutional rights under color of law – Title 18 U.S.C, Sections 241 and 242, in case you've forgotten."

"Don't be ridiculous."

" . . . witness-tampering, alteration of evidence. . . ."

"Take your hands off me, you dumb hillbilly! Charlie!"

But Charlie, confronted suddenly with the business end of Jim Atwater's service revolver, was much occupied with holding his hands up.

". . . and intentional endangerment of the health, safety, and welfare of this community in the opinion of our Chief Health Officer, Dr. Petrovich. Alex, you reckon I need to quarantine him, what with his known exposure to this dangerous fungus?"

Tolson's eyes bugged out, but with his hands cuffed behind his back, he could do nothing. "You. . . ." Words evidently failed him.

Alex nodded judiciously. "Better safe than sorry, Sheriff. Will you be using that little cell at the old jail?"

"Yep. Let's go, Tolson."

"Lee," Atwater said, "What do you want me to do with this gentleman?"

"Well, with charges of aiding and abetting all of the above, we'd better reserve our Presidential Suite for him." The sheriff grinned. "Who knows, maybe if he thinks about it for a while he'll see the wisdom of cooperating."

Tolson laughed. "If you think you can get away with this, you are sadly mistaken!"

Her eyes shining, Sherri Lynn gazed up at Atwater. "Oh, Jim, you were wonderful!"

Frank smiled to himself. A man wanting to impress a woman—it just made the world go 'round.

Jim blushed. "I can't take all the credit. Shirley and Rita Hackleford sent the faxes and organized the demonstration. Most of the signs are from last year's tax protest."

Petrovich laughed and slapped his knee. "I love it! Tolson has no idea what he stepped into, getting the Shirleys of the world mad at him."

Two days later, Sherri Lynn came into Frank's office carrying a loaf of bread, golden-brown and fluffy as a cumulus cloud. "Well, Dr. Murphy, what do you think?"

Frank held up his free hand, with the other he clutched the telephone, not wanting to miss a single word. ". . . need a doctor who can think on his feet, but most of all, we need someone who deals well with the isolation and our people. The Moon needs *men*, not romantic dreamers fed up with paying taxes. Think you're the one for the job?"

"Yes, sir!"

"E-mail me, and we'll get started on this."

"Yes, yes, right away! Thank you, Ian! You won't regret this. Bye now." Frank hung up, his eyes glazed. "Sherri Lynn, I think I'm going to the Moon. It'll take longer to pay off my school loan, but . . . oh, isn't it wonderful?"

"It sure is, Dr. Murphy. I knew you'd get there. So how do you like my bread? Isn't it *gorgeous?*"

"It certainly is." Frank wondered how he could possibly pack everything he needed into a sixty-pound weight allowance. If he quit eating bread, dropped a few pounds. . . .

"Jim says I should enter my recipe in the County Fair. It's only a week away."

"Good idea." Frank fixed her with a gimlet eye. "Sherri Lynn, I've never been good at concealing things, so with all those reporters around over the last couple of days I've kept a lid on my curiosity. But I want to know how those biots got into Elmo. There's no way he could *possibly* have gone home so quickly on conventional therapy."

She lowered her eyes. "You're right. He did get a dose of biots."

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"How?"

"Well, you see, Jim took the jars from the FIG evidence locker and switched them with the yeast. Then he gave one to Elvis, and Elvis mixed up a dose and gave it to him."

Frank frowned. "But how did FIG get the packages so early? They weren't supposed to arrive until that morning."

"Oh, you know how they are—too smart for their own good. They had their eye-in-the-sky track the packages, Echelon something. Anyway, they took the packages right out of the Post Office mail and flew them here direct. Jim says it was coming up on funding time for FIG, and they wanted a big dramatic bust that would make all the Greenists in Congress happy." She looked pensive. "I guess I shouldn't be surprised Lt. Tolson wiggled out of the charges now that Congress's made tobacco illegal."

"But . . . but how did Jim know to switch them for yeast? And how did he know to use a Canadian brand?"

Sherri Lynn looked offended. "Because I told him to. It was my yeast, from home, with a phony label we printed on the laser printer in my office. I scanned it from my cooking class literature. As for knowing it had to be Canadian—how could I possibly miss that? You cc'd all your e-mail to me."

"Sherri Lynn, I really underestimated you. That was truly brilliant."

She beamed. "Thank you, Dr. Murphy."

"By the way, what happened to the other jar?"

"Oh, that. I gave it to Elmo for a going-home present. I figure it'll come in handy for his next batch of moonshine."■

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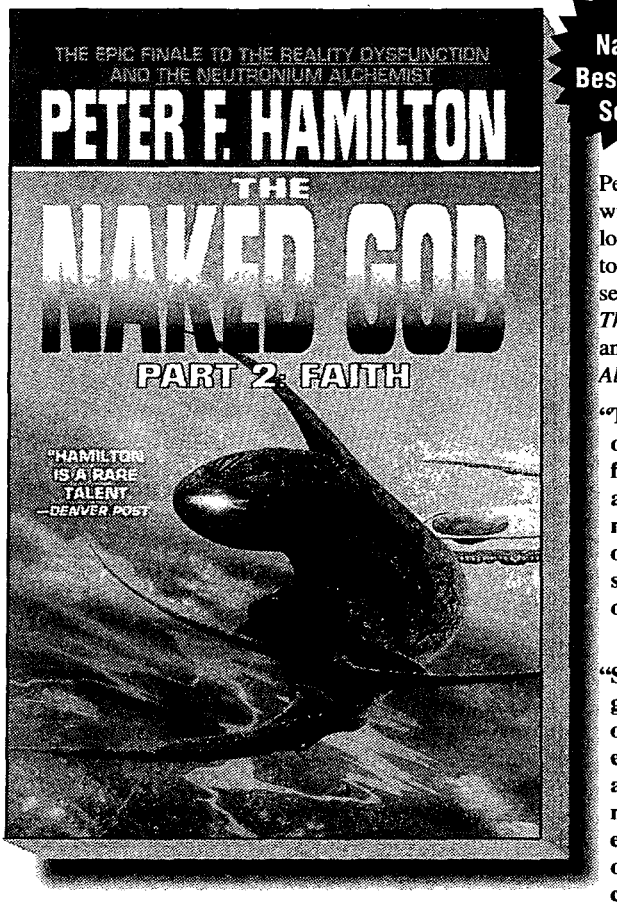

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BIOLOG Jay Kay Klein

FRAN VAN CLEAVE

Fran Van Cleave has studied chemistry, pharmacology, physics, mathematics, evolution, and medicine, tempered with history, constitutional law, and other human constructs. She has learned German, Spanish, and Latin, with Navajo picked up as a bonus. In contrast, billions of people neither know, nor care to know, much of anything beyond immediate arm's length. But then, neither do they long to feel the crunch of Martian sand underfoot.

Fran notes that the people running the industrial countries are mostly lawyers and businessmen who know little of science and not much of history. They make fateful decisions in blissful ignorance or in accordance with superstitious prejudices. Laws get passed denying evolution, suppressing life-saving research, prescribing required worship, and permitting destruction of the environment. The technological marvel of television is filled with ads for fortune tellers and bible thumpers seeking donations. Herbal remedies, alternate medicines, New Age theories, and nutty doomsday gurus skew life for millions.

Robert Heinlein and André Norton were Fran's mentors, and she was raised on SF. Her mother died when Fran was eight. Her father was an engineer who read SF, but converted to Islam and went off on a personal quest for six months, leaving a 12-year-old Fran and her 10-year-old sister alone to cope by themselves. With Fran's rational abilities, they did just fine, and never missed a day of school or attracted attention. From age eight, Fran read *Analog* regularly. The editorials were mind-expanding and unlike anything taught in her Catholic parochial school. She wanted to be an astronaut eventually, and thought grownups were silly to think they ought to solve problems on Earth before going into space. *Analog* clearly pointed out that expanding into space was the solution.

She brought SF and science books to class and read them inside textbooks. Heinlein showed her she would have to learn things on her own to prepare for advanced education. That's how she learned trigonometry and organic chemistry with an assist from Isaac Asimov's primer. SF did fail to predict that space travel would be given up after a few trips to the Moon, and disappointed that a career as an astronaut seemed impossible, she put herself through the University of Arizona for a B.S. in Pharmacy. SF was put on hold for a while.

Life opened up when she joined Mensa. The editor of the *Mensa Bulletin* loved SF and had a wonderful collection of books. These acquainted her with the full range of SF writers. Marriage followed, and Fran started writing. Kent Van Cleave is now pursuing an advanced degree in the philosophy and history of science. Fran's first story appeared in the September 1997 *Analog*. Her first novel is making the rounds with publishers, and a second is under consideration by an editor.

Born in Boston, Fran was raised in New England and southern California. She has lived in Phoenix, Tucson, and on a Navajo reservation. Home is now a small Indiana town not far from Bloom-

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ington. She is a hospital pharmacist and has worked in other hospitals, several prisons, and three Indian reservations. A brush with the wrong arm of the law occurred when she walked into an armed bank robbery, backed out quietly, and called the sheriff's office. They didn't think she sounded excited enough to be taken seriously. She is continually exasperated by people who think a woman has to act emotionally all the time.

SF sequences appear in her dreams, and story dialog pops into her head while awake. Being a full-time writer is her goal. She wants to present her visions of the future, where people not only aim for the stars, but keep trying until they get there. She has wanted to walk on the sands of Mars since childhood, a wish that I and, undoubtedly, many *Analog* readers share. Until we get there, Fran Van Cleave can tell us what it's going to be like. □

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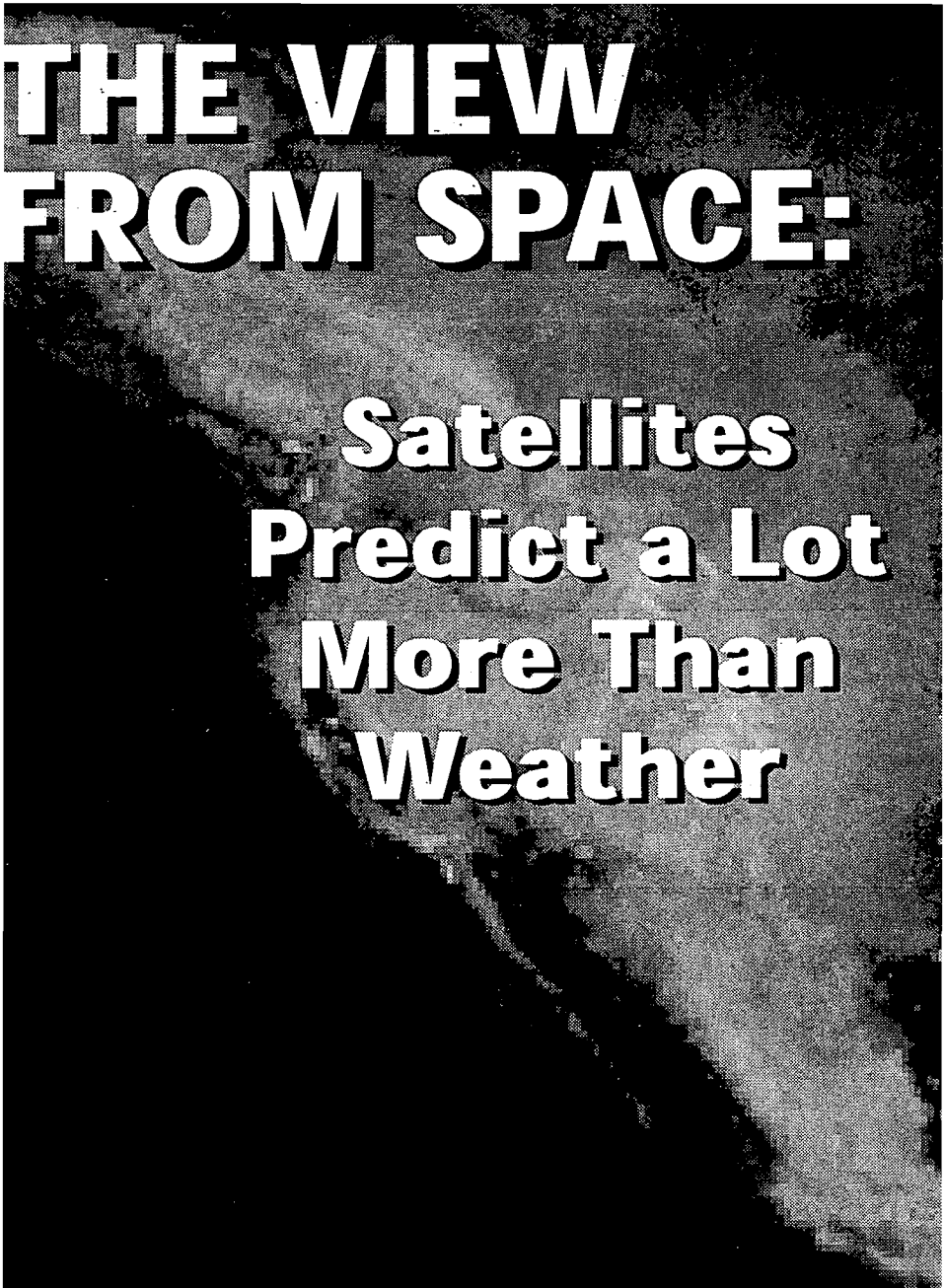
THE VIEW FROM SPACE:

Satellites Predict a Lot More Than Weather



Richard A. Lovett, Ph.D.

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On a recent hiking and driving tour of the Southwest, I stopped to visit my cousin Ann, a government biologist who monitors federally protected desert tortoises near the vacation meccas of southern Utah. She invited me to spend an afternoon in the field, checking up on the activities of a dozen of the slow-moving creatures, which she'd previously tagged with radio beacons, glued to their shells.

It started as old-fashioned low-tech work, listening to the *beep-beep-beep* of a frustratingly vague directional antenna, as we alternately clambered over lava rocks or trudged through soft sand.

Then we found the first tortoise. Ann calmly pulled a GPS unit out of her pack, clicked it on, and waited a few seconds while it communicated with orbiting Global Positioning Satellites to triangulate the tortoise's position—including its elevation above sea level—to the nearest few feet.

It was the second time in less than a month that I'd found researchers routinely using these devices for tasks that would have been much more painstaking only a few years before. Earlier, I'd visited an agricultural experiment station in Yuma, Arizona, where scientists had linked a GPS device and a laptop computer to a tractor rigged to pull a conductivity sensor across agricultural fields. The result: soil salinity maps of an entire field in about 30 minutes—valuable for farmers seeking to fine-tune their irrigation practices.

Neither of these pieces of research represents a spectacular innovation. Rather, they illustrate how the twenty-first century realities of satellite-based remote sensing are rapidly outstripping science fiction. And they point to a future in which satellite monitoring will become as much a part of daily life as satellite telecommunications are today.

It's not that science fiction hasn't long recognized the value of satellites. *Star Trek*-style explorers routinely launch probes to map exotic new worlds. But stories rarely ask what type of data these probes might collect, or how to recognize "life signs" or indicators of alien civilizations. Nor do they ask how routine use of such data might influence long-civilized planets, such as earth.

This omission isn't really surprising. Satellite-based research is a wide-open field, limited mostly by the innovativeness of researchers from fields with no obvious association to astronomy. If you've got a really good idea for a new use of satellite technology, chances are it can already be done. Most satellite experts would rather get research grants than give away their best idea via stories.

Here's a potpourri of current research, using optical, infrared, and range-finding laser satellites that could be used for interstellar exploration as easily as they're currently being used in the solar system.

Computer-Game Reality for Urban Planners

In the popular computer game Sim City, simulation-game aficionados lay out urban transportation grids and set land-use rules in an effort to create viable communities. They then observe from a bird's-eye view as their constructs draw businesses and residents or decay into urban blight. The program even allows players to zoom in on individual people walking to bus stops or trapped in automotive gridlock.

Real-world urban planners are more likely to be stuck in traffic themselves than hovering omnisciently above it. But they too have an eye in the sky they can use to chart the impact of their decisions at a scale roughly comparable to the size of the average suburban lot. It's called Landsat, and successive generations of Landsat cameras have been photographing the earth's surface since the 1970s.[1]

Thanks to decades of newspaper and magazine publicity, everyone's seen Landsat images: false-color photos that mix visible and infrared light (particular-

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ly useful for distinguishing vegetation types) to produce images so crisp it's easy to trace the boundaries of subdivisions, golf course fairways, or farms. What's new is an increasing resolution, including computerized image-enhancement algorithms, that allows ever-more-sophisticated uses. The program also has an archive of 30-meter-resolution photos that now covers a long enough time period to allow useful time-series studies.

These photos have been used to compare urban growth on at least three continents. Similar photos have also been used to help city planners avoid creating conditions that turn cities into artificial furnaces that not only are unpleasant to live in, but can have significant impacts on local weather.

Jeffrey Masek, of the University of Maryland's Department of Geography, has used Landsat data to compare urban growth in Washington, D.C., and Portland, Oregon—two very different cities. His goal is to answer two fundamental questions of urban geography: How do cities grow and how easy is it to direct this growth through regional planning?

Washington and Portland have pursued radically different methods of managing growth. In Portland, a powerful three-county planning authority has established a zone, called the Urban Growth Boundary, outside which development is severely constrained. In Washington, D.C., there is limited regional authority, and growth patterns are controlled—with varying degrees of strictness—by at least ten state, federal, and local jurisdictions.

Masek compared satellite data from the 1970s, '80s, and '90s, looking for one of the signatures of urbanization—the disappearance of farms and natural vegetation. With a few corrections to account for changing agricultural practices, it's possible to create a computer algorithm that seeks out areas where open space has been replaced by houses, lawns, roads, parking lots, industries, or shopping centers. The computer program is then fine-tuned by having a human satellite-imagery expert examine selected areas and compare his findings with the computer's.

"Overall," Masek said at a remote-sensing symposium at the 2000 annual meeting of the American Association for the Advancement of Science, "it's about eighty-five percent accurate, which is about as good as you're going to get from remote sensing techniques. They're never going to be perfect."

Eighty-five percent accuracy was sufficient to show the difference between the two types of urban governments. In the Washington metropolitan area, development often leapfrogged ahead of transportation networks, spreading over a wide radius. Comparing the rate of urban buildup to population data, Masek calculated that the metropolis was eliminating about 400 square meters of open space for every new resident—although growth was better controlled in some counties than in others.

In Portland, growth is much more restricted. Only 100 square meters of land is built up per new resident, and despite a population boom, virtually all of the growth has been confined to the Urban Growth Boundary. It's a space-based validation of the city's planning scheme. "Urban planning can work if it's given enough teeth to be enforced," Masek said. "We see that from the satellite imagery."

The use of remote sensing in urban planning isn't limited to looking at overall growth. It's also possible to compare growth patterns to public transportation routes, thereby determining whether land-use decisions are encouraging people to live near rail lines or disperse into the countryside where they have no option but to use cars. Or the urban buildup maps can be compared to other mapping data, such as the locations of computer services. Not surprisingly, both Portland and Washington, D.C., show their highest growth in areas

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where computer services are concentrated.

Overall, Masek sees a virtually unlimited future for remote sensing in urban geography. "We can assemble a global atlas of urban growth, look at the ways cities develop—and find the causes," he says.

Not all urban geography can be done by Landsat. Dale Quattrochi of NASA's Marshall Space Flight Center needed conventional aerial surveys to obtain a finer, 10-meter resolution to supplement a thermal study of Atlanta, Georgia.

Quattrochi was interested in the urban "heat island" effect, which raises city temperatures by several degrees, as development strips away vegetation and replaces it with heat-absorbing roofs and pavement. During summer days, these structures can hit surface temperatures in excess of 120°F, while at night they retain this heat enough to still be 35°F hotter than outlying forests and farms.

It's a strong enough effect that cities can create atmospheric thermals that generate thunderstorms, often at times of day that defy weather patterns in the surrounding farmlands.

But the heat island effect also exacerbates smog by increasing the rate of ozone formation. "If we could lower the temperature of Atlanta by one to two degrees Celsius," Quattrochi says, "we could bring down ozone by ten to fourteen percent."

Aerial mapping allows the researchers to identify hot spots within the heat island—the best places to begin efforts at counteracting its effect. Such regions practically jump off the face of Quattrochi's thermal maps. Some are scorching, treeless "deserts" that could benefit from tree planting, for shade and evaporative cooling. Others have dark surfaces that absorb tremendous amounts of sunlight. "Why is it that roofs are black, particularly in the Southeast?" he asks. "Why not make them white to reflect heat rather than absorb it? Why is asphalt black? Why can't we embed white paint in the surface to make it more reflective? We're trying to see what Atlantans can do to cool their city."

Vulcan from Orbit

It is no surprise that the Web site for the University of Hawaii carries a map of the state's Big Island. But the image posted by the school's Institute of Geophysics & Planetology isn't a road atlas. It's low resolution even by Internet standards, and glows in blurry blobs of russet, green, and blue.

The "map" is an infrared satellite photo, updated every fifteen minutes. It provides a thermal image of the island as viewed from orbit, far above the Pacific Ocean. The same web site also carries infrared pictures of several other areas, including parts of Guatemala, the Galapagos Islands, Chile, and Montserrat.

To earth scientists, these seemingly disparate locales have one important factor in common: they're geologically active sites where volcanic eruptions are regular occurrences. The institute's web site allows volcano researchers working from any computer in the world to detect the precursors to volcanic eruptions in these areas as far as a week in advance.

The Hawaiian volcano-watch program is a byproduct of climate monitoring via the Geostationary Environmental Satellites (GOES) administered by the U.S. National Oceanic and Atmospheric Administration.

Geostationary satellites are ones like communication satellites, carefully positioned to circle the Earth precisely once per day. By orbiting at exactly the same rate as the Earth spins, they effectively hover above fixed spots over the Earth's surface, allowing those portions of the globe to be scanned as often as desired. The infrared data are collected by the U.S. Naval Research Laboratory in Monterey, California, then forwarded to the university for analysis.

The GOES images aren't fine-grained images like those produced by military spy satellites; from their 35,000-km ele-

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vation, the GOES infrared sensors can't resolve anything smaller than about four kilometers in diameter. But they can locate "hot spots" that might mark incipient upwellings of lava.

The actual hot spot may be 800°C to 900°C, but the pinprick of intense heat is too tiny to spot directly. Instead, the weather satellite is more apt to map it as a 5°C to 10°C increase in average temperature in the vicinity of the eruption.

The university's computer program is automated to monitor about a dozen preselected spots on the globe every fifteen minutes in search of new activity. When a hot spot is detected, interested scientists are automatically notified by e-mail so they can log onto the web site and watch the event themselves.[2]

How far in advance an eruption can be observed varies from mountain to mountain. Vulcanologist Luke Flynn, who heads the program, cites Pacaya, a 2,550-meter peak in Guatemala, as one for which the system works particularly well, perhaps because that mountain's magma chamber is close enough to the surface for lava movements to produce easily detectable heat signatures. Pacaya is also a volcano of considerable safety concern because it lies close enough to the Guatemala City airport to sometimes dust the runways with ash.

"We see some sort of heating before large-scale events at Pacaya," says Flynn. "We saw three events in 1998—in May, June and September—all preceded by an increase in thermal activity that the GOES detected seven, four and three days ahead of the main event."

The volcano research is complicated by the fact that the researchers are looking for temperature anomalies, not just for regions exceeding a specified temperature. In other words, they must be able to distinguish "hot spots" from hot days. "We can get temperatures of above 60° C out on the lava flows at Kilauea [in Hawaii] even when they're not active," Flynn notes.

The solution is to compare infrared emissions at two wavelengths: one at approximately four microns and the other at about eleven microns. The eleven-micron band is quite sensitive to temperature changes in the range normally seen on earth; the four-micron band reacts weakly to those, but much more strongly to temperatures in the range seen at active volcanoes. Comparing the two allows researchers to distinguish volcanic activity from the action of sun on black rock.

In addition to volcanoes, the Hawaiian computers can also spot forest fires. "Currently we're monitoring the entire U.S. West Coast," says Flynn. "If a fire gets to be half a football field in size, we can spot it within fifteen minutes, if there are no clouds."

Oceans and Ice Caps of Mars

Radar has been in common use since World War II. The concept is simplicity itself: if you bounce an electromagnetic pulse off a suitably reflective surface, you can use the speed-of-light delay to measure the object's distance.

What's newer is the ability to measure time with almost unbelievable precision. Since 1998, a satellite-borne instrument called the Mars Orbiter Laser Altimeter (MOLA) has been using radar to create detailed topographic maps of the Martian surface, precise enough that scientists eventually hope to distinguish elevation gradients as small as half a meter.

The satellite fires nearly a million incredibly brief (eight-nanosecond) infrared range-finding pulses at the surface each day, timing their echoes' delay to the nanosecond. Mapping the entire planet is facilitated by putting the satellite in a polar orbit—one that zips from one of the planet's poles to another, circling north-to-south rather than around the equator. As the satellite orbits, the planet spins beneath it, allowing a different portion of the surface to be mapped with each pass until, after about seven days, the entire globe has been covered.

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Twenty-seven million radar pings were enough that in 1999, the U.S. National Aeronautics and Space Administration (NASA) was able to publish a Martian topographic map with measurements no farther than 60 kilometers apart at the equator (and much closer at the poles). Since then, the satellite has pinged the planet more than 300 million additional times, compiling increasingly detailed maps. Along the path of each of the satellite's thousands of orbital tracks, the radar pings the surface every few hundred meters, creating even more detailed elevation profiles of the features directly below it.

Mapping elevations to a precision of less than half a meter requires the ability to time the returning pulse to an accuracy of about a nanosecond. That doesn't push the limits of today's hyperaccurate clocks, but it does hit the boundaries of two other technologies. One is the sensor that monitors the laser pulses. The eight-nanosecond pulse produces a matching echo whose broad peak is difficult to time with much greater accuracy. A larger obstacle is the fact that the satellite is moving in an orbit that isn't perfectly circular. Variations in its distance from the surface are therefore combinations of two factors—surface terrain and changes in the satellite's orbital height, which can vary from 375 kilometers to 445 kilometers. At the time NASA published its 1999 planet-wide topographic map, the engineers had only determined the orbital parameters with sufficient precision to allow a thirteen-meter accuracy in maps of hilly terrain, with large flat areas measured to an accuracy of better than two meters.

For most purposes, that's pretty good. It's certainly better than a lot of earth-based maps. "We now know the topography of Mars better than many continental regions on Earth," said Carl Pilcher, the National Aeronautics and Space Administration's Science Director for Solar System Exploration in an Internet press release.[3] "The data will serve as a basic reference book for Mars scientists for many years, and should inspire a variety of new insights about the planet's geological history."

Based on the parade of scientific papers presented in 1998 and 1999, that claim is, if anything, an understatement. Pick your favorite Mars riddle, and the MOLA data probably have something to add.

Did Mars once have water? Very possibly, says David Smith, of NASA's Goddard Space Center. Using maps color-coded to show differences in elevation, he and coworker Maria Zuber of the Massachusetts Institute of Technology can trace the direction water flowed though numerous channels and can spot flat-bottomed depressions that were probably seas, lakes, or ponds in the process of silting in when the water disappeared. The MOLA data even reveal structures that appear to be beach terraces left by the receding oceans—features that photographic images were unable to detect.

How much of this water is now in the Martian polar ice caps? The range-finding data can't prove that the ice caps are made of water, or determine the amount of dirt that might be mixed in with them, but they do allow scientists to map the polar caps' elevation profiles. This allows a straightforward calculation of the caps' volume—giving an upper bound on how much water they might contain.

The 3D maps themselves support the belief the caps are predominantly water, revealing structures that require greater rigidity than is possible with frozen carbon dioxide or other alternatives. If the caps weren't water, they should have flowed and flattened into rounded pancakes, rather than standing high in the center, Smith says.

Averaging slightly more than a kilometer thick, the north polar cap is the better studied of the two, sprawling across an area 1.5 times the size of Texas. Its volume is half that of the Greenland ice

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cap—or about four percent that of the Antarctic ice sheet. If melted, it would cover the planet twenty to thirty meters deep—a substantial body of water, but far less than the volume the MOLA data indicate is necessary to fill the planet's ancient ocean beds. Where the other water went remains a mystery.

Nearly as interesting is the local topography of the ice cap itself. Large areas are smooth plains. But the radar carried one big surprise: The ice cap is cut by numerous canyons unlike anything seen on earthly ice caps. Some are more than 3,000 meters deep. "They appear to be carved by wind and evaporation of ice," says Zuber.

Also intriguing are outlying mesas of ice dozens of kilometers in length and nearly 1,000 meters tall. Flanking the ice cap like icebergs on a sea of sand, they appear to be remnants from a shrinking ice cap—again raising questions about where the missing water might have gone.

The north pole is also surrounded by 15-meter to 50-meter sand dunes, reminiscent of the deserts of North Africa. And the cap itself shows a layered structure, which may be the result of seasonal accumulations of new material, just as the earth's glaciers form in layers with each year's snowfall.

Although the poles are the best-mapped sections of Mars, the MOLA data have found plenty of other interesting features. Overall, they confirm that Mars is mountainous—more so than Earth if one defines the term simply by the elevation difference between the highest and lowest points. On Earth, that's about 17,000 meters, from the Marianas Trench in the western Pacific Ocean to the top of Mt. Everest. On Mars, there's a 30,000-meter range between the highest and lowest points. The planet is also slightly egg-shaped, with the southern hemisphere averaging 5,000 meters higher than the northern hemisphere.

The southern hemisphere, however, has an immense depression, the Hellas impact basin, where something hit the planet with incredible force, ages ago. The crater is deeper than Mount Everest is tall, and it's enormous—2,100 kilometers in diameter. The explosion that created it must have hit with a blast like the one that demolished Washington state's Mt. St. Helens 21 years ago—only magnified a millionfold in force, spewing out enough debris to cover an area the size of the United States to a depth of 3,500 meters. Some of that debris was thrown as far as 4,000 kilometers from the crater and is one of the reasons the southern hemisphere is higher than the northern one.

Surface features aren't the only things that reflect infrared radar. Cloud patterns in the thin Martian atmosphere can also be mapped, showing everything from carbon dioxide fog to the equivalent of cirrus clouds at elevations up to 15,000 meters. Frequently, these clouds form at the boundaries between the ice caps and the surrounding terrain, where they show turbulence patterns similar to those that occur when Earthly clouds collide with mountains.

A few of these clouds even show wispy tendrils descending toward the surface. "It's the first precipitation we've ever seen on another planet," Smith says. "But it's not water. It's carbon dioxide snow."

"Night Lights" from Space

Humans don't like dark. Even those of us who claim to be night owls banish the primeval night with streetlights, headlights, flashlights, or simple candles and campfires. There's enough of this illumination to be easily seen from space, where it shows as spangling networks of cities spreading across the globe in the twinkling patterns of industrial civilization.

It's not just astronauts who have noticed this phenomenon. Satellites can photograph it, using the results to map the density of worldwide urbanization

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with more accuracy than the most meticulous census documents. These maps can, in turn, be used to help rally aid for hurricane relief, assist in land-use planning, or monitor variables related to global climate change.

The data are collected through the Defense Meteorological Satellite Program (DMSP), using sensors designed to monitor nighttime weather for military pilots.[4] For instruments sensitive enough to see clouds by the weak glow of moonlight, mapping human activities is a snap. Not only can the DMSP satellites spot the steady lights of cities, but they can also find intermittent lights in areas frequented by nighttime fishing vessels, and short-lived ones from fires.

Maps of this nighttime illumination provide striking images of the extent of global civilization. And because most of the planet's surface can be monitored, it's data that's free of sampling error. "You're looking at essentially everything," says Mark Imhoff of the National Aeronautics and Space Administration's Goddard Space Flight Center.

The maps give frightening clarity to the spreading ecological footprint of human activities. North America, Europe, and parts of Asia blaze with the high-intensity luminosity of industrial civilization. In Egypt, the Nile Valley is a thread of light snaking downstream from Aswan Dam. Squid boats lure their catch to the surface with submarine lights along the coasts of Japan, and the glow of field burning stains Southeast Asia, the Amazon rainforest, and sub-Saharan Africa.

"It's a very powerful snapshot," Imhoff says. "What you see is that much of the tropics are on fire, while much of the Northern Hemisphere is urbanized."

This much is obvious even from the unprocessed data. But with a bit of image enhancement, it's possible to turn up the resolution to a one-kilometer grid. The chief technical obstacle is an optical effect known as "pixel blooming" that makes bright lights seem larger than they are—much as a similar photographic effect converts the pinpricks of stars into disks on astronomical photographs. But once this effect is eliminated, the light-density maps give a rendition of urban sprawl that can be calibrated against census data. "The match [in the U.S.] is so good there's no statistical difference," says Imhoff.

Elsewhere, the data can be calibrated against local census figures with correlations that are nearly as strong. One important difference, however, is the size of the smallest village that can be seen from space. In China, says Douglas Way, a "night-lights" researcher from Ohio State University, there are towns of 4,000 to 6,000 people that don't emit enough energy to trigger the satellite sensors. In the U.S., "a village of 200 people illuminates the pixel."

Even where it's not perfect, the satellite map is superior for many uses to the best census data because its one-kilometer grid is finer than that used for land-based population counts.

This makes it a potent tool for geographers. Imhoff, for example, has used it to quantify the effect of urban sprawl on U.S. farmlands—a task that proves to be a straightforward job of overlaying the night-lights data on a geographical map of soil types. The comparison immediately shows which soils are being built over at the fastest pace.

To do this, Imhoff used soil maps that rate the obstacles to farming on a nine-point scale designed by the United Nations. "Zero" indicates the best agricultural lands, found in such places as America's Midwest. "'Eight' means good luck trying to farm it," he says. Such soils dominate the bare granite of the Sierra Nevada and the toxic landscape of Utah's Bonneville Salt Flats.

Imhoff's mapping shows that the nation's efforts at farmland preservation have met with mixed success. The very best soils—the "zeros"—prove to be better preserved than might be expected from the tendency of cities to grow

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near the farmlands that provide them with food, markets, and easy transportation. But those soils appear to have been spared at the expense of soils in category "one." These second-best soils are disproportionately dominated by urban sprawl, even in the top agricultural states of California, Florida, Illinois, and Wisconsin.

It is also possible to examine soil types in more detail, based on an ecological scheme that has identified approximately 300 soil categories in the U.S. alone. "Some are almost completely covered by urban sprawl," Imhoff says. "Scientists at the University of California, Berkeley, are now looking at the impact on biodiversity."

Overall, three percent of the U.S. is urbanized—a seemingly small percentage that actually represents a much higher fraction of the better agricultural lands. In California, Imhoff says, sixteen percent of the best soils have already been developed, and another forty percent lie in the path of future development. Similar numbers hold for Florida and Wisconsin.

Disappearing farmland isn't the only aspect of urban sprawl that can be tracked from space. Way notes that if the total amount of illumination is plotted for all of the world's 192 countries, there is a very strong correlation to reported carbon dioxide emissions. "Not that one would ever use this to monitor the Kyoto Protocol[5]," he says, "but it's interesting."

Imhoff has used the remote data to look at another aspect of global warming, overlaying the night-lights data on a satellite map depicting the "greenness" of the daytime landscape.

"Greenness," as monitored from space, is slightly more complex than a simple measure of the visible light that makes plants look green. It uses a mix of visible and infrared measurements as a signature for the amount of chlorophyll being seen by the sensors—a proxy for the rate of photosynthesis in the area being scanned. Since that is related to an ecosystem's ability to purge carbon dioxide from the atmosphere, combining the greenness and night-lights data provides a fairly direct measure of the way urban sprawl affects the earth's defenses against CO_2 buildup.

The result proves to depend on both the degree of urbanization and climate. In Florida, where temperatures rarely drop below freezing and photosynthesis continues year-round, urban areas lose the annual equivalent of twenty-two days of photosynthetic productivity. "It's like turning the lights off in a greenhouse for twenty-two days per year," Imhoff says.

But in Denver, Colorado, urban residents plant grass and trees, irrigating them in a climate that is otherwise too dry for such luxuriant growth. Denver's urban sprawl actually increases photosynthetic productivity by the equivalent of eleven days' sunlight per year.

Most U.S. cities, however, are like Chicago. There, urban sprawl affects local temperatures, creating a relatively warm "heat island." In the spring and fall, this prolongs the growing season, but in the summer the city becomes too parched. Overall, there's a five-percent productivity decline.

Summing this across climate zones, Imhoff says, indicates that urbanization has already robbed North America of ten days' carbon-fixing productivity per year.

Global warming is a long-term problem. But satellite data can also be used to predict the impact of sudden events like tropical storms and earthquakes.

When a cyclone strikes or an earthquake hits, Way says, all that's needed is to enter the coordinates onto the night-lights urbanization map to discover quickly how many people will be affected. That way, relief agencies will instantly know the likely extent of the disaster and be able to start mobilizing aid—even before the first scattered reports come in from the ground. For example,

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he notes, the remote-sensing data instantly show that ten million people lived within fifty miles of the epicenter of Turkey's recent disastrous earthquake, and satellite maps of India showed seven million people in the path of a recent killer typhoon. With data like that, nobody has to wait for news reports to know that such events will be devastating.

It's also possible to spot future problem areas in the hope of minimizing impacts in advance. Way notes that the maps show that India has twenty million people living where earthquake risks are rated as "catastrophic" and fifty-four million at high risk from cyclones. "A national planner might want to consider locating new urban centers outside of these risk zones," he says. "The potential for a natural catastrophe in India is rather high."

India also has a long-term problem with rapid urbanization and a population projected to exceed China's by 2030. Combining night-lights data with satellite photos of road networks allowed Way to develop a model that predicts urban growth with eighty-five percent accuracy when tested against 1989-1999 data. Projecting this model into the next few decades shows that India will lose three percent of its total agricultural land, mostly from the most productive districts. Couple that with the country's expanding population and it doesn't augur well for the nation's food self-sufficiency goals—or for worldwide grain prices as it is forced to import vast quantities of food.

The Satellite-Sensing Future

These are but a few of the uses to which the expanding arsenal of orbiting scientific instruments can be put. With a growing library of images stored on Internet-accessible computers, future uses are almost unlimited. Already researchers are employing satellites to chart the effect of global warming on the Antarctic ice cap, or to help calculate how much irrigation water is available for the arid West from each winter's snowfall. In the future, real-time satellite images may be routinely used by police to track fugitives, or by search-and-rescue crews to seek lost hikers. They'll also play an increasingly important role in foreign policy, as nations with access to space-based facilities develop ever-more-sophisticated ways to monitor the activities of friends and enemies alike.

Currently, satellite-image uses are limited mostly by resolution, data-processing capacities, clouds, and the users' ingenuity. Of these, only clouds are likely to be a long-term limiting factor. Satellite-based sensors will continue to improve as military equipment becomes declassified. Increasingly powerful computers will be given access to Internet data banks, from which intriguing analyses can be teased out of existing images by programs such as those used by Masek and other urban-planning researchers. As the resolution of publicly accessible images increases from the current thirty-meter Landsat limit to ten meters and perhaps even one meter, researchers will find ways to examine these images on an ever-finer grain until eventually they may practically be able to count the dandelions in suburban yards.

On the ingenuity front, "overlay" appears to be the watchword for the near future, as researchers invent new ways to tease out relationships by comparing satellite and ground-based maps. Many of these will be so simple that when they appear in the evening news, the only response will be, "Gee, I wish I'd thought of that."

The computer-driven, image-enhancement future will also see increased use of multiple-frequency scans of each tract, as researchers seek infrared/visible light combinations that provide signatures for all sorts of conditions not previously tracked from space. Potential candidates are numerous, and some are already feasible: droughts, insect infesta-

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tions, crop diseases, air and water pollution plumes, forests and grasslands that are ripe for catastrophic wildfires. With only slightly better resolution than that provided by current Landsat images, it should also be possible to zero in on smaller-scale events. Just as photo-radar is surprising speeders in school zones, satellite monitoring might nail "midnight sprinklers" who defy lawn-watering bans during times of water shortage. TV and radio stations may be able to substitute space-based images for helicopter surveillance of traffic jams, and may even be able to receive real-time reports on parking availability for holiday shoppers at local malls.

There are persistent rumors that the military already has satellites good enough to read license-plate numbers. Even if these are myth, an order-of-magnitude lower resolution is enough to track individual people. If such images can be compiled in real time, like space-based movies, police may be able to train satellite cameras on high-crime neighborhoods, playing back the tapes to follow criminals home from the scenes of their crimes. Once that becomes known, crime would vanish in areas exposed to satellite surveillance. Law-abiding citizens will no longer be afraid to go out after dark—but might be afraid of staying indoors where criminals can't be tracked from space. Wooded parks might see their trees thinned to improve space-based monitoring, and cloudy nights might become reasons to stay home and lock the doors.

Many of these uses will be noncontroversial. But there's something very intrusive about the prospect of invisible eyes in the sky peering into your backyard. More is at stake than simply the privacy of nude sunbathers.

George Orwell's classic book, *1984*, spawned the slogan, "Big Brother is watching you." In Orwell's world, however, people were spied on via neighbors and bureaucrats monitoring two-way televisions. Long before 2084, Big Brother could be far less obvious, sitting up in space, its omniscience limited only by the ability of high-speed computers to process the flow of data.

In a benign future, these invisible overhead observers will be under the control of geographers, urban planners, agricultural researchers, vulcanologists, and climatologists whose interest is the welfare of humanity as a whole. In a not-so-benign future, individual people will be tracked from space to a degree that makes today's direst invasion-of-privacy concerns seem minor. The late Twentieth Century taught that the real Big Brother is more likely to be commercial than governmental. If inexpensive online images become available at one-meter resolution, there might be a new breed of satellite marketers who use automated computer algorithms to seek out households whose lawns need fertilizer, whose gardens lack the latest breed of tomato seeds, or whose redwood decks are overdue for new coats of water sealant.

It's a realm that's ripe for a few good cautionary tales. Or maybe it's already time to buy land in cloudy climates such as Iceland or the Pacific Northwest. ☒

[1] For background information and a gateway to lots of interesting material, go to http://mtpe.gsfc.nasa.gov/landsat/.

[2] The Web site is http://volcano1.pgd.hawaii.edu.

[3] For more information on the MOLA program check http://ltpwww.gsfc.nasa.gov/tharsis/mola.html.

[4] Images can be accessed on the Web via http://spidr.ngdc.noaa.gov:8080/production/html/BIOMASS/night.html.

[5] The Kyoto Protocol is an international agreement to combat global warming by reducing worldwide emissions of carbon dioxide.

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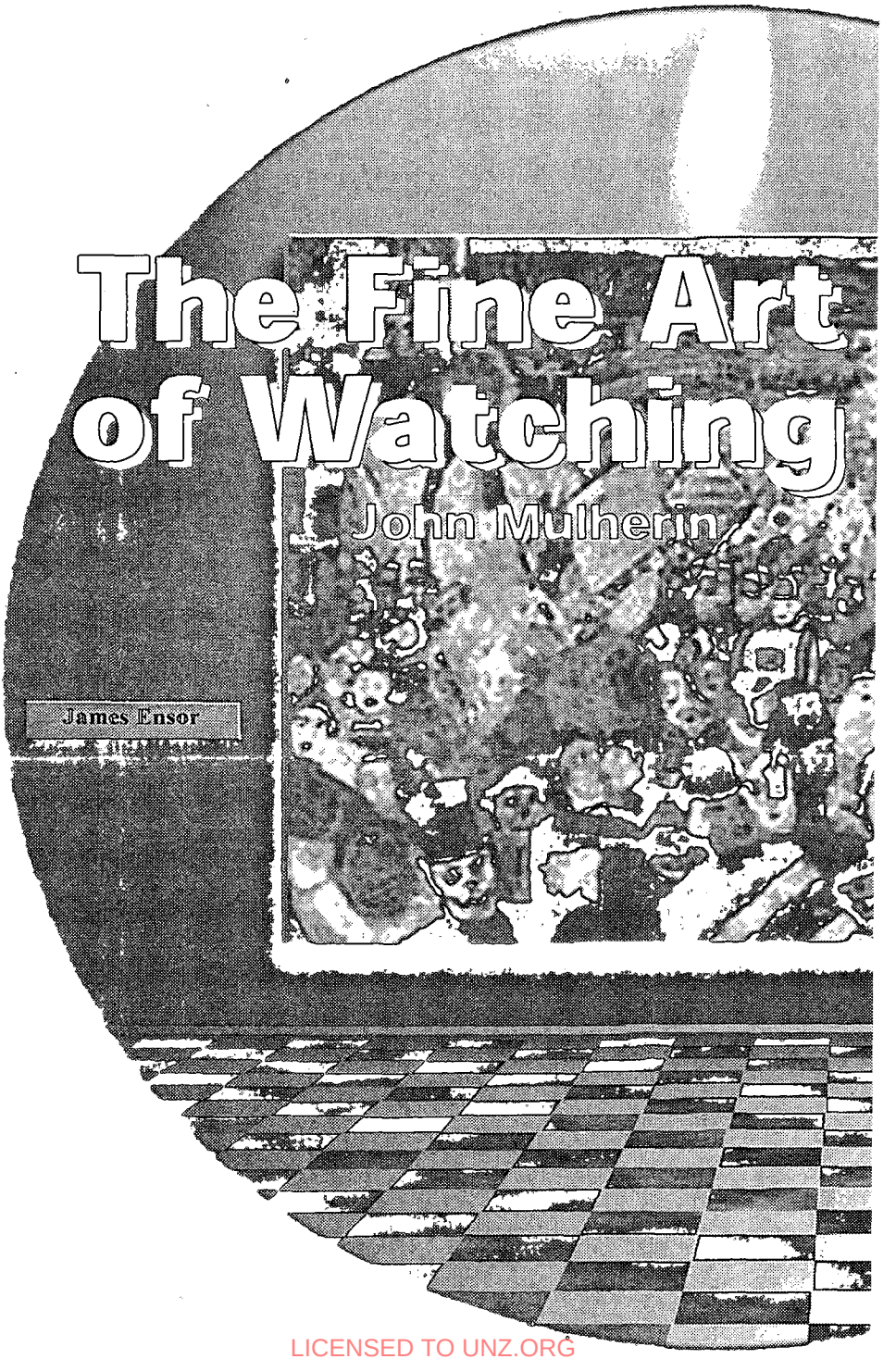

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Observation is an essential skill—and so is knowing what to observe.

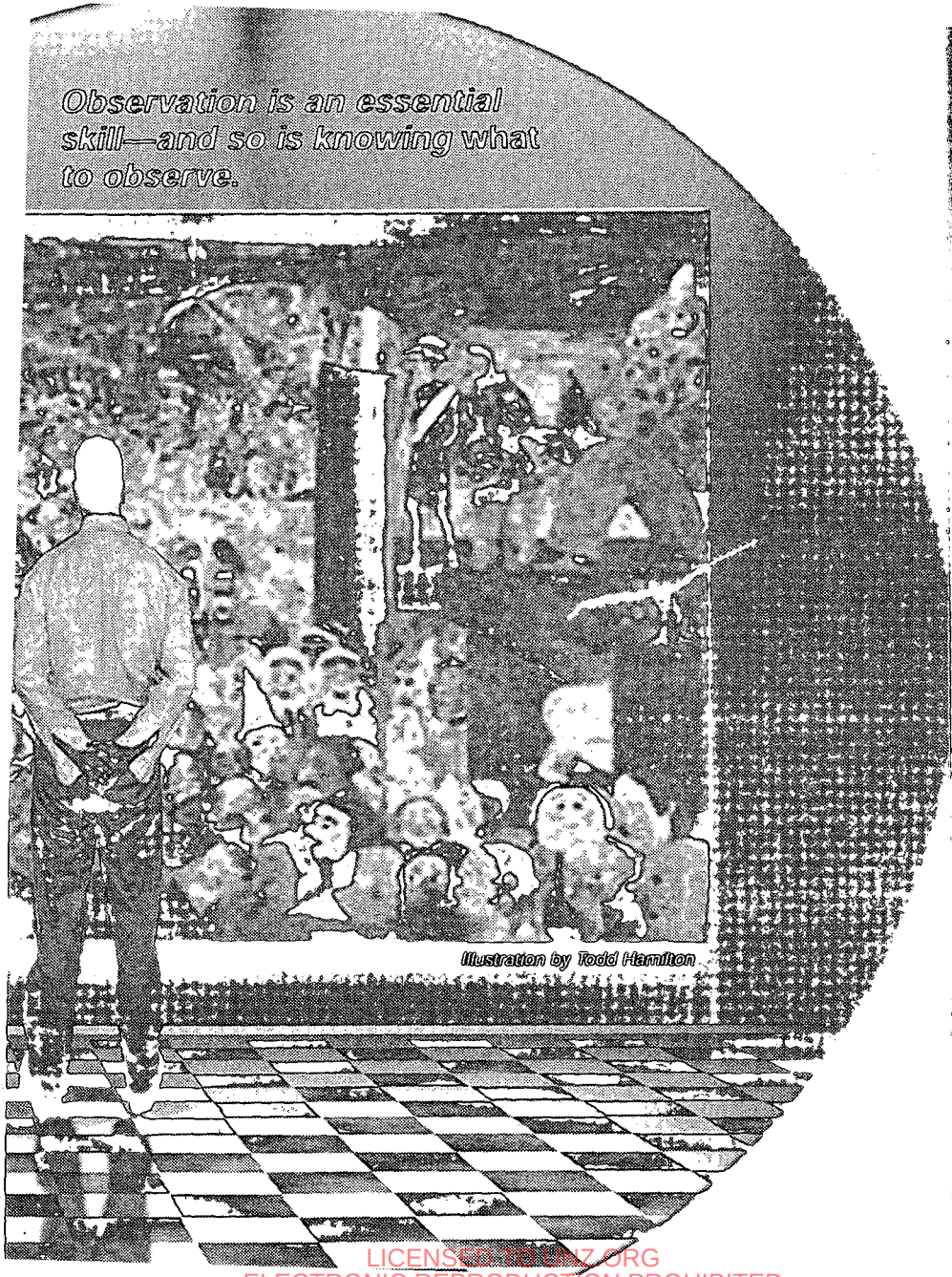

Illustration by Todd Hamilton

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"*Two hours, Blue. Are you sure we're in the right place?*"

Mr. Coffey was having a bad morning. Through my earpiece I could hear the impatience in his voice, as cantankerous as a child who had been made to sit in the car while Mom and Dad went shopping. This was the second time Ed had asked that question in the last half-hour, and the question was just as pointless now as it had been thirty minutes ago. Either we were or we weren't, and if we weren't, I'd have some hard questions of my own.

I glanced up from the guidebook I had been pretending to read for the last couple of hours, gazed across the Getty's front plaza toward the tram station. A digital clock above the awning read 11:59. A short distance down the monorail track I could see the tram itself, slowly moving up the hill toward the museum.

"Stand by, Green," I murmured, ducking my head a little so that none of the handful of people loitering around the plaza would observe me talking to myself. "Red, are you in position?"

"*Affirmative, Blue,*" Michaela replied. Her voice was very quiet in my ear, and I resisted the temptation to glance behind me to make sure. Wide concrete steps led up from the plaza to a broad promenade directly in front of the art museum. Michaela would be sitting on a semi-circular bench beneath a shade tree, also pretending to read something while she kept an eye on me from about forty feet away. She was a trained professional, so she knew how to remain innocuous while on stake-out. Or at least so I had been told; this was my first field operation with her as a partner, and her reliability was only one of many questions in my mind.

The electric tram had reached the top of the hill, and now it silently moved past the blue casement windows of the auditorium building as it approached the station. I closed the guidebook and tucked it beneath my arm as I stood up from the bench and sauntered toward the snack kiosk in the center of the plaza. Futuristic and dazzling white in the California sun, the J. Paul Getty Center sprawled across a west L.A. hilltop like the Acropolis of Athens as reimagined by a Hollywood set designer; I wondered how many scenes for made-for-TV science fiction movies had been filmed here. In the far distance rose the Hollywood Hills, dun-colored desert mountains overburdened by the terra-cotta homes of movie directors and rock stars. I couldn't see it from where I stood, but the surveillance van was somewhere up on an undeveloped ridge overlooking the San Diego Freeway, parked on a service road off Sepulveda Boulevard where Mr. Coffey would have a clear line of sight down upon the Getty. If I stood close to the wall at the southern end of the plaza and waved my arms, Ed might be able to see me if he was peering through the telescopic lens of one of the cameras he kept aboard the Spookmobile.

Yet Mr. Coffey wasn't watching us that way. Or at least he shouldn't be. I stopped in front of the kiosk, looked up at the menu board above the counter, and raised my hand to cover my mouth as if I was about to cough. "Green, where's the flycam?"

"*Look up. I'm repositioning now.*"

Raising my hand against the bright midday sun, I glanced upward just in time to catch a glimpse of a small, swift form as it purred overhead, whisking about sixty feet above the plaza as it moved from the flat rooftop of the restaurant building to the roof of the auditorium. If anyone else had spotted it, they probably would have mistaken it for a hummingbird, yet no one paid any attention save for the Hispanic lady standing behind the counter. She gazed at me curiously, perhaps wondering if I was ever going to visit the museum or simply hang out in the plaza and drink iced latté all day.

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"Can I help you?" A vaguely worried smile. I had visited her little bistro twice already. Behind her, the tram was coasting into the station.

"Umm . . ." I made a pretense of studying the menu as I watched the tram. It glided to a halt within the narrow groove of the station platform; a moment passed, then its doors slid open, and I could hear a recorded voice politely telling its passengers to watch their step as they left. Yet each of its cars were only half-full; it was a Tuesday morning in late October, midweek, well past the height of the California tourist season, and although you still needed to make advance reservations, the Getty wasn't as popular as it normally was during the summer months just past.

Nonetheless, quite a few people got off the tram which visitors took from the underground parking garage at the bottom of the hill. Unless you happened to work here, it was the only way to enter the Getty. Still making a show of examining the menu board—did I want latté, espresso, cappucino, chi, or just a plain, ordinary Diet Coke?—I stepped to one side to get a better view of the tram while still keeping the kiosk between me and the platform. Out of the corner of my eye, the counter lady lost interest in me and turned away. There's something about L.A. which lends itself to people with short attention spans.

Earnest-looking art aficionados, ponytailed Hollywood yuppies, UCLA students toting daypacks, Asian tourists, beautiful young women with expressions of perpetual boredom and legs slightly shorter than a giraffe's, all tanned from afternoons spent in Malibu and dressed in the loose-fitting, open-necked pastels which are Southern California's contribution to global fashion. Sallow of complexion, dressed in a charcoal business suit, I suddenly became aware of how much I stuck out. Not good for covert work. I was unknotting my tie and slipping it off from around my neck when I spotted our primary target, one of the last passengers to disembark from the tram.

"Black is here," I whispered, the bone-convection mike concealed within my sunglasses picking up my words as clearly as if I spoken them aloud.

"*Copy that, Blue,*" Mickey replied. "*I see him.*"

A short, slightly overweight man just past sixty, with longish dark hair recently turned silver, Black wore a tan sport coat and a black cashmere mock-turtleneck. He had a rolled-up magazine beneath his left arm. If he was nervous in any way about what he was doing, he was very good at not showing it. He strolled out from beneath the station awning, paused briefly to glance around the plaza—I ducked back behind the kiosk and counted to five—then began to saunter toward the stairs, following the crowd as it headed toward the museum.

"*I've acquired Black,*" Mr. Coffey said.

"Keep him in sight. I'm following." I waited until he was on the stairs, then I slipped out from behind the kiosk and picked up his tail.

OK, freeze-frame. Let's take a minute to find out who the good guys are and who are the bad guys.

Black was Jack Edgar, Ph.D., a senior biochemist employed by a large pharmaceutical corporation which made its headquarters in Long Beach. About three months ago, his company was caught by surprise when one of its chief European rivals, a biotech firm in Italy, suddenly announced a process for producing tPA—tissue plasminogen activator, a kind of blood anti-coagulant used by hospitals for treating heart attacks—which was remarkably similar to one which Dr. Edgar's division had been developing for several years. All at once, its lead in bringing a valuable product to market was imperiled, along with several hundred million dollars in R&D money and potentially ten times as much in long-term revenues.

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It looked very much as if someone at Company A was selling secrets to Company B, but in order to successfully prosecute a patent infringement suit against the Italians, Company A had to prove that its tPA process had been stolen. That's when Company A called Company C—Falcon Associates, Ltd., which specializes in handling such matters, with great discretion and at a considerable price.

After ten weeks of investigation, Dr. Edgar had emerged as our prime suspect. As a major player involved in the tPA project, he had complete access to everything at his company's research labs. Furthermore, he lived beyond his apparent means; in the last few months, he had abruptly traded in his four-year-old BMW for a new Porsche and had moved from a condo in Redondo Beach to a nice hilltop house in Sherman Oaks. Of everyone working at Company A whom we checked out, Edgar most closely fit the profile of an insider selling corporate secrets for cash.

Yet no one could figure out how he was getting the material out the door. To its credit, Company A had long since enacted tough—some might say draconian—security measures which were meant to insure that its crown jewels stayed safely locked away. Visitors were never allowed to enter the research facilities, and everyone who worked there had to sign in and sign out at the front-door guard station. No paper files were permitted to be taken home, and the guards inspected everyone's briefcases, shoulder bags, and satchels before they were allowed to leave the building at the end of the day. Phone calls were monitored, computer files were encrypted upon creation, and all email was filtered through online censors who inspected every single memo for proprietary information.

Nothing Dr. Edgar had done while he was employed by Company A had ever raised a red flag, yet when our people examined company security records, they noticed an odd thing. On the last Tuesday of each month, Dr. Edgar would leave the office around midday to go somewhere. He simply signed out at about 10 a.m., then would reappear at the lab by around 2 p.m.. He did it so quietly that no one at his company noticed his absence, yet nonetheless there was always a four-hour gap in his monthly schedule which he had never explained to anyone.

Last month, after he had made one of these little disappearances, one of our operatives had paid a visit to his office shortly after the company closed for the day. Again, nothing he had left on his desk, in his file cabinet, or in his computer appeared suspicious. Even the little dunking bird which watered itself at the glass upon his bookshelf had no secrets to tell. Yet our operative was nothing if not thorough; she upended the trash can next to his desk and searched every piece of litter which fell out onto the carpet. And lo, what did she find but the two torn halves of a car pass for the Getty Center, time-stamped for 11:40 that very same day.

We used our usual resources—namely, sweet-talking and bribery—to check the Getty's guest-reservation list through the past twelve months, and it turned out that Dr. Edgar had visited the place on the last Tuesday of every month, always at the same time. Counting midday traffic time on the 405 from Long Beach to West Hollywood, and it all fit together: Dr. Edgar had established the Getty as a regular rendezvous point.

And that's where my team and I come in.

So here's Black, Dr. Jack Edgar, trooping up the polished white steps of the Getty, just one more Los Angelino in search of a little high culture to enliven an otherwise dull day, blissfully unaware that he's being shadowed by two spooks and something that looked like a toy RC helicopter. Yet he was a cautious man. As he got closer to the top of the stairs,

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he paused again to look around. I made no sudden moves, but simply drifted a little to the left so that I remained in his blind spot. I couldn't see Mickey, which was good because it probably meant that Black couldn't see her either. A tiny shadow flitted across the steps; that was Ed's flycam, making like a sparrow as it flew from the auditorium to the flat, curved roof of the museum.

Black noticed none of this. Pulling his magazine from beneath his left arm, he idly swatted against it his thigh as he continued walking up the steps to the promenade. I was still forty feet behind him, though, so I lost sight of him as soon as he left the stairs.

"I've lost Black," I murmured.

"*Got him, Blue.*" Through the crowd, I caught a glimpse of Mickey as she stood up. A slender woman of average height, with long blond Botticelli hair tied back in a dark blue bow, she wore wide-frame sunglasses and a calf-length black dress with a long slit up one sleek thigh. Subtle, she was not; if she had been surrounded by lingerie models, I still would have noticed her. I had questioned her appearance earlier this morning before we left the hotel, telling her that she needed to learn how to melt into a crowd, but she had smiled and given me the benefit of a small observation: when the average guy spots a good-looking woman in a crowd, he tends to immediately look away. A quick size-up and that's it; unless the woman in question makes direct eye-contact, most men tend to be shy around alpha females, instinctively sensing them as being too threatening. Hence, according to her, a well-dressed woman is the perfect camouflage.

I don't know whether this was something Mickey figured out on her own or if it was the product of Mossad training—it sure didn't sound like any CIA tradecraft I'd ever learned—but I wasn't going to argue. If the tail was blown because she had been spotted by the target, though, you could bet I'd take away her Lord & Taylor catalog once we returned to Washington.

"*He's entering the museum,*" Coffey said, and I quickened my pace, trying not to appear in a hurry as I half-jogged up the remaining steps. "*Stay on him, Red.*"

No answer from Mickey. She was probably too close to Black to risk voice contact. I reached the top of the stairs just in time to see her strolling toward the glass doors of the museum. Ten feet in front of her, Black was just then entering the building. The door shut behind him, and Mickey was on him.

So far, so good . . . but then I saw something new.

A guy with curly blond hair, wearing a blue windbreaker, sitting on a semicircular bench in front of a rock fountain. He was watching Black, and when he walked into the museum, he folded his brochure and stood up to follow him.

Black's contact? I couldn't be sure, but he was behind Mickey and she hadn't spotted him. I raised my hand as if to clear my throat. "Stand down, Red," I said softly. "He's mine."

Mickey heard me; she stopped just before she reached the door, turned to glance sharply in my direction. Out of the corner of my eye, I could see the dude in the windbreaker casting a curious glance in our direction. Damn it, now we were attracting attention to ourselves. Even if Black wasn't looking back to see if he was being followed, there was a strong chance that his contact might.

"*Hey, what's going on down there?*" Mr. Coffey demanded.

No time to explain the situation to either of them. I put a big, sheepish grin on my face as I marched toward her. "Honey, I'm so sorry," I exclaimed, taking her by the arm and stepping her away from the door. "I didn't see you get off the tram."

Mickey caught on. "I didn't see you either," she said evenly, forcing a smile of her own as I gave her a quick buss on

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the cheek. "I was about to go in by myself."

Behind us, the last few people from the tram were entering the museum. Curly didn't pay any further attention to us as he fell in among them. I gave Mickey a hug, whispered in her ear: "Stay here and cover the door, I'll call if I need backup."

"*Blue, this isn't the game plan,*" Ed snapped. "*What are you doing?*"

Mickey wanted to ask the same thing, but she couldn't. She gave me a go-to-hell look as she stepped back. "Excuse me," she said, forcing sweetness into her voice, "but I think I need to powder my nose."

"Okay," I replied. "I'll meet you back here." She glared at me through her sunglasses, then she turned and strode away.

That little public tiff may have saved our cover, but it also cost us valuable seconds. When I entered the museum's air-conditioned foyer, Black was nowhere to be seen, and neither was Curly. The uniformed security guard standing just inside the door gave me the eye as I hastily glanced around. Nearly everyone who had entered the museum was heading for the ground-floor galleries, but a few were walking up the circular staircase leading to the second floor. I had to take a chance, so I chose the stairs.

The second floor was a maze of cool, silent rooms with polished parquet floors and track lighting suspended from the high ceilings. Every step I took seemed to echo off the aquamarine walls no matter how quietly I tried to walk.

An art museum. Man, what a perfect place for a contact. Everyone is looking at the stuff on the walls instead of each other, yet the place is so quiet a ballerina in practice shoes would sound like a soldier stomping through in winter boots. Black might be an amateur, but he had picked his rendezvous site like a pro.

I moved quietly from one room to the next, my hands folded behind my back, trying not to look as if I was in a hurry. The photosensitive lenses of my sunglasses had cleared, and now I could see the artwork clearly. Here, I found the late Italian Renaissance: Mantegna's *Adoration of the Magi*, Bartolommeo's *The Rest on the Flight into Egypt*, Dossi's *Mythological Scene*. No sign of either Black or Curly, so now I drifted into the next room to check out the Dutch masters: Rembrandt's *The Abduction of Europa*, Steen's *The Drawing Lesson*, Van Dyck's *Thomas Howard, 2nd Earl of Arundel*. A couple of Russian tourists got a little too close to Rembrandt's portrait of St. Bartholomew before a security guard appeared from nowhere and politely moved them away, but by then I was heading for the room filled with stuffy English and French portraits.

Still no Black, and now I was getting the lousy feeling that I had made the wrong decision. I paused in front of Jacques-Louis David's *The Sisters Senaide and Charlotte Bonaparte* and cleared my throat again. "Red, go in and check the ground floor."

Nothing but static. Damn! I should have known better. Our communications link was being relayed through the Spookmobile; however, since Coffey was parked way the hell over there, its low-watt radio signal couldn't penetrate the museum's thick granite walls. This was the reason why Ed hadn't parked the Honda SUV in the underground garage beneath the Getty; not only did he need to have a clear fix on the fly-cam, but he also needed to be able to receive signals from our headset radios, and that would only work if we were all out in the open. Although he and Mickey were still able to talk to each other, I was now out of the loop.

And I'd lost Black.

Fighting down panic, I quickly left the room. Through the doorway was a circular corridor leading around a central atrium well. California sunlight washed

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through a skylight in the ceiling far above. Muttering obscenities beneath my breath, I marched around the atrium to the next gallery, walked through the door . . .

And nearly collided with Dr. Jack Edgar.

"Uhp . . . excuse me."

"No problem." Dr. Edgar stepped aside without so much as a second look, went back to examining the painting on the wall next to the door.

Now we were with the French impressionists of the late 19th century. I tried not to do a double-take as I sauntered past him, heading for Cézanne's *Still Life with Apples* on the opposite side of the room. There were a couple of other people in the gallery, closely studying Manet's depiction of a Parisian street on the morning of Bastille Day. Behind me, Dr. Edgar continued to savor Monet's conical wheatstacks with the first snow of winter upon them.

We circled the room for the next few minutes, Black and I, our backs turned to one another, stalker and prey. After a few moments the other visitors left the room, heading for another gallery, leaving him and me alone among the company of masters. He moved to the Cézanne and I went to check out the Manet. In the foreground was a one-legged man in a blue coat, hobbling on crutches down the Rue Mosnier; somehow, I knew exactly how he must have felt. Black idly tapped the folded magazine in his hand against his leg as he went to inspect *Wheatstacks, Snow Effect, Morning*, and I chose that moment to shift my attention to the handsome young lovers in Renoir's *La Promenade*.

I was just beginning to realize how subtly Renoir had utilized light and shadow when I heard Dr. Edgar leave the room. I counted to three, then glided after him, keeping him in sight as he moved into the next gallery. I was about to follow him through the door when I saw him approach an enormous canvas which took up one entire wall: a vast parade down a European street, dozens of people in odd costumes—clowns, witches, a skeleton in a top hat, a man dressed like a cat—passing before a reviewing stand, with a laughing cardinal in a miter leading the procession and a uniformed marching band not far behind. A scarlet banner overhead read "Vive La Sociale." A colorful and very strange work of art; it vaguely reminded me of the album cover of the Beatles' *Sgt. Pepper's Lonely Hearts Club Band.*

Standing by himself in the room, Black stared at the mural for a long time, transfixed by its cryptic beauty. I hung back, lingering just outside the door, allowing Dr. Edgar that moment alone with this weird masterpiece.

After a couple of minutes, he glanced one way over his shoulder, then the next. I quietly moved back one step, avoiding his wary gaze. When I looked back again, he had moved to the plaque on the wall right of the mural, apparently to read the description of the piece.

He was now holding the folded magazine in front of him. As he studied the plaque, he seemed to be absently curling it within his hands, yet as I watched closely, his right hand traveled to its back cover and did something I couldn't quite make out.

Was he removing something from the magazine?

Behind me, a pair of slow footsteps were entering the room in which I stood: a young couple, making quiet conversation as they wandered through the museum. I moved a little away from the door, pretending to examine the nearby Manet while I kept an eye on Dr. Edgar.

Then, in a moment which passed so quickly I might have missed it if I hadn't been watching him so keenly, his right hand moved to the plaque. He gently stroked its top edge with the tips of his fingers, barely seeming to touch it . . . then his hand fell back to his side and,

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after another second or two, he stepped away from the wall.

Black gazed at the mural for another minute. A furtive smile briefly stole across his face. I'd seen that sort of smile before, in the years when I had worked in Nairobi for the CIA; in that instant, I knew that he had made his drop.

He turned and walked away from the huge painting, once again idly tapping the magazine against his thigh. On his way out of the room, he paused next to the door; another quick look around, then he pulled out a small piece of chalk and made a tiny, almost unnoticeable white mark on the doorframe.

I waited until I heard his footsteps fade down the corridor, then I entered the gallery.

As much as I wanted to rush straight to the plaque, I had to restrain my curiosity; a roving security guard chose that moment to walk through, briefly giving me the eagle-eye as I stood before the mural. Through the doorway on the far end of the gallery, I caught a glimpse of Black sauntering through the next room, no longer interested in any of the art displayed on its walls. Mickey would pick up his trail as soon as he left the museum. I waited until the guard had disappeared into the room I had just left, then I walked over to the plaque.

The mural was titled *Christ's Entry into Brussels in 1889*, and it was painted in 1888 by the Belgian artist by the name of James Ensor. There was a bit more to the description than that, but my patience was at its end. I reached up and, ever so carefully, ran my fingertips over the clean plastic top of the plaque.

A strip of tape.

That was all. A mere strip of Scotch tape, about three inches long.

I found the guidebook in the pocket of my jacket, opened it to its first page. Then I slowly and gently peeled the tape off the top of the plaque, making sure that it didn't curl in upon itself. In the few seconds before I transferred it to the front inside cover of the book, though, I quickly examined it.

Neatly flattened against the tape was another strip of tape, and enclosed within those two strips, like a lab specimen captured within a flexible microscope slide, was a single strand of hair. A human hair, silver-grey, its follicle still attached to one end like a minute dewdrop.

I carefully plastered the tape and its valuable cargo within the cover of my book, then I closed it and walked away to study the other paintings in the room. The French impressionist movement was really ahead of its time; I took the opportunity to relish the other Monets and Cézannes on display, always keeping an eye on the mural. The young couple cruised through the room and stopped for a moment to gaze upon the Ensor, then they eventually moved on. A yuppie came yapping through the gallery, giving the masterpieces around him barely more than a passing glance as he quarreled with his agent on his cell phone about how to get Tom and Nicole to read his screenplay. The security guard made his patrol, coming and going like a ghost. I studied trees and rivers and lonely avenues in southern France, and hoped that Green was observing Black's return to the tram station.

About five minutes later, Curly strolled into the gallery, his hands thrust in the pockets of his jacket. Noticing my presence at the opposite end of the room, he hesitated just inside the door, but I kept my back turned to him and pretended not to pay any attention. He brushed his left elbow against the doorframe, erasing the chalk mark Black had left behind, then he slowly walked over to the mural and spent a minute or so in silent contemplation of the Second Coming.

I left the room and entered the adjacent gallery, feeling his eyes on my back. I waited a few seconds, giving him time to feel comfortable, then I quietly slipped to the edge of the door and peered around frame. By then he moved

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to the wall plaque. When his hands emerged from his jacket pockets, I caught a brief glimpse of a plastic sandwich bag.

As I watched, he reached up to the top edge of the plaque, ran his fingers across it. His back was turned to me, so I couldn't relish the look on his face, but he went so far as to actually stand on tiptoe to visually inspect the plaque.

Footsteps from outside the room, coming closer. Curly hastily shoved the sandwich bag back in his pocket and stepped away from the wall, moving a little closer to the Ensor. A moment later, the security guard entered the room. He glided over to the bagman and tapped him on the shoulder, silently admonishing him not to stand so close to the mural. Curly scowled at him, but obediently moved away.

I turned and quickly strode through the room behind me, ignoring the remaining artwork as I followed the signs to the exit. Two quick turns, and I found myself back at the stairway I had taken from the ground floor.

Mickey was impatiently waiting for me just outside the front door, her arms folded across her chest. She started to say something, but I cut her off. "Did you see Black come out?" I asked, and she nodded. "Green, did you get a clear shot of Black?"

"*Caught him on the way back to the tram.*" Ed's voice came clearly through the earpiece. "*Jesus, Blue, what the hell happened to . . . ?*"

"Never mind that now. I've intercepted the drop." Michaela's mouth opened and her eyes widened in surprise as I took her arm and led her away from the museum entrance. "Black's handler is still inside. Where are you positioned right now?"

"*Directly above you, on the roof,*" he replied, and I instinctively looked up. I couldn't see the flycam from where I was standing, but the rooftop was three stories above me. "*What does he look like?*"

"Tall, curly blond . . . never mind. Can you see me?"

"*No. Can you get a little farther away from the building?*" Mickey followed me as I took a few more steps out onto the promenade. "*Okay. Got you both. Now who am I looking for?*"

"Wait a minute, and I'll introduce you." I looked back at Mickey, favored her with my most annoying grin. "You're still smoking, aren't you?"

She hesitated. The boss had been bugging her to kick the habit ever since she joined Falcon Associates, and she had conned him into believing that she had given up cigarettes. But I could smell tobacco on her breath, which meant that she had sneaked a butt while I was inside. "Of course not. I've . . ."

"Gimme one." I looked over my shoulder to check the door. Black's handler hadn't appeared yet. "Green, get airborne and come down low."

She had just dug her pack of cigarettes—Gitannes, yuck—from her handbag and shook one out for me when Curly pushed open the door. Judging from his gait and the expression on his face, he was mighty upset just now. Good. I was about to piss him off even more.

"*Blue, what are you . . . ?*"

"Just do it." I snatched the cigarette from Mickey's pack, then turned and walked toward Curly just as he was striding past us.

He was almost about to brush past me until I stepped in front of him, raising the cigarette to my mouth. "Pardon me, *signor* . . . do you have a light?"

I used the only word of Italian I knew beyond a restaurant wine list, but that stopped him. The handler hesitated. "Sorry," he said, and I wasn't surprised to hear an Italian accent, "but I don't smoke."

A faint whirring sound from just above us. "Neither do I, to tell the truth," I said, then I suddenly pointed above his head. "Hey, look up there . . .!"

He pivoted on his heels, looked up . . .

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and there was the flycam, a miniature helicopter with a camera lens protruding from its bulbous fuselage, hovering barely ten feet away. Its propwash stirred his hair as he stared at it gape-mouthed shock.

"Have a nice day," I said, then I put my arm around Mickey's waist and walked her away from the museum.

Curly stared up at me from the miniature liquid-crystal screen of the Panasonic portable DVD player, his face frozen in a timeless expression of astonishment. The flycam had captured him beautifully; I had little doubt that, once the images were analyzed by the boys and girls in Intelligence, they would be able to match his face against their files of known covert operatives. Before I passed the disk to them, though, I wanted to make a hard copy of this shot for myself, just to pin up on my bulletin board.

I heard the flight attendant coming down the aisle, and snapped the player shut before she could ask me to switch it off. The American Airlines 767 was still climbing to cruising altitude; it was highly doubtful that the minuscule electromagnetic field generated by the player would interfere with the cockpit instruments, but I didn't want to get in an argument with the person whom I would depend upon to deliver bloody marys all the way home to Washington. She passed through the first-class cabin with a silent look of admonishment in my direction; she knew what I was doing, and I knew that she knew, but neither of us were willing to lock horns over the issue.

Michaela still wasn't speaking to me. She idly flipped through the copy of *The New Yorker* she had picked up just before we boarded the plane, and continued the cold-shoulder treatment she had been giving me ever since Mr. Coffey picked us up in the Spookmobile outside the Getty. I sat up front with Ed; we chatted about the assignment until we reached LAX, where he dropped us at the main passenger terminal before driving the minivan over to the air cargo center for shipment back to Dulles International. Mickey and I were taking a separate flight to Reagan National. All the time Mickey quietly fumed in the back seat; I had to ask her twice to burn me a second copy of the flycam footage, and even then she did so grudgingly. I decided to let her stew for a little while longer; we had a four-hour flight in front of us, so we certainly had time to hash things out when Mr. Coffey wasn't around.

So I savored my bloody mary—a little on the bland side; next time I'd have to ask the flight attendant if she had any Tabasco sauce—as I gazed down at the arid, overdeveloped landscape falling away beneath the plane. The late afternoon sun illuminated the suburban sprawl west of Cucamonga, catching the thick plume of smoke rising from the latest forest fire in the San Bernardinos and tinting it a lovely shade of red.

The overhead console made its *dink* sound, signalling that the pilot had switched off the seatbelt sign and that we were now free to move around the cabin or play with our little electronic toys. I opened the DVD player again and took another moment to relish the look on Curly's face one more time, then I switched it off and unbuckled my seat belt. The business traveller sitting in front of me cranked back his seat a few inches, and the close-up view of the airphone nestled in his seatback reminded me that I had some unfinished business of my own.

I started to reach into my jacket for my wallet when Mickey shifted her legs, folding her left knee over her right. The sole of her high-heeled boot lightly kicked my ankle, and she muttered something that almost sounded like an apology. That was enough of an icebreaker for me.

"S'okay. No problem." I made a little show of trying to get at my wallet, even

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though it was easily within reach. "Hey, do you have the company phone card? I can't get to mine."

"Hmm? Yeah, sure." Mickey unclipped her seat belt, turned the magazine face-down in her lap, then reached forward to pull her shoulder bag from beneath the seat in front of her. "Calling in?"

"Uh-huh. I want to let them know what to do about the package." That being the small plastic bottle in my jacket which contained the strand of hair I had found in the Getty. Ed had volunteered to take it with him to Washington, since his flight was scheduled to arrive shortly before ours, but I was reluctant to let it out of my sight. I pulled the phone out of its recessed cradle and swiped Mickey's card through the slot, then dialed the company's secure switchboard number.

"Falcon Associates," the operator said.

"Blue Priority One," I said. "Cardinals over Orioles in the eighth inning."

This was the password which not only verified my identity, but also informed them that I was speaking on an unsecured phone. "Thank you. How can I direct your call?"

"Shipping department." That was the code word for Forensic Science. A brief pause, then the phone buzzed a few times. I checked my watch; it was 4:45 Pacific Standard, which meant that it was a quarter to eight in D.C. I hoped someone on the third floor would be working late.

I was about to give up when the phone was picked up on the seventh ring. "Forensic . . . I mean, Shipping Department," a distracted male voice said.

I immediately recognized its owner: Jim Kessler, one of the sharper pencils in our desk drawer. The boss had recruited him only last year from the FBI, where he had been working overtime for slave wages at its National Crime Lab. Jim wasn't earning much more at Falcon, to tell the truth, but at least he didn't have G-men breathing down his neck all the time. We were drinking buddies when we were off the clock.

"It's Blue. What's happening, dude?"

"Nothing much. Just chillin' in the loading dock." Which meant that the boss had him stay late at the lab to wait for my call. "I hear you've got something interesting for us."

"Oh, yeah. You're going to like this one." I resisted the temptation to go into details. "Look, we're probably not going to get into D.C. until well after two a.m. your time, so you might as well go home."

"Thanks, pal. I appreciate it." I could hear him smiling over the phone. The last thing he wanted to do was spend the night at the office, waiting for two jet-lagged field operatives to come traipsing in from California.

"No problem, but look . . . can you get access to an electron microscope? The sooner the better. Like, first thing tomorrow morning?"

A sigh. He wasn't off the hook yet. "Yeah, sure," Jim said after a moment. "I know some people I can call."

"Give 'em a buzz tonight, willya? I'm sure the boss is going to want us to hop on this soon as possible."

"I'll set it up before I leave. You're going to owe me one for this, you know."

I knew what he meant: steak dinner at our favorite Georgetown watering hole, with yours truly picking up the bill. It wasn't a hardship; after noshing on lightweight California cuisine for the last four days, I was ready for some East Coast red meat and potatoes. "No problemo. You the man."

"Yeah, yeah . . . see you tomorrow."

"Nighty-night," I replied, but he had already hung up. I let the phone cord retract the receiver back into its socket, then I turned to Mickey. "Done. I'll bring it to the office in the morning."

"Uh-huh." She had picked up *The New Yorker* again and was skimming the film reviews. She was putting on a pretense about not being much interested in my conversation, but I knew that

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she had been hanging on every word. "So what's this about an electron microscope?"

"Nothing. Just operational details." Two can play this game; I touched the armrest button, let my seat fall back a few inches. The video screen was descending from the ceiling two rows in front of us; I reached into the seat pocket and pulled out the plastic bag containing the headphones. "Any idea what the movie is?"

"The new *Star Wars*, I think." Mickey reluctantly put aside her reading material to pull out the in-flight magazine; she aimlessly riffled its pages back and forth before surrendering to the inevitable with an exasperated sound. "OK, I'll bite. Why do you need an electronic microscope?"

I ripped into the bag, pulled out the headphones. "Let's talk about you first. You're upset about being left outside, aren't you?"

Mickey hesitated, still playing with the magazine. "You could put it that way, yes," she finally replied, dropping her voice a little. Not that she really needed to; across the aisle, an elderly man was loudly blowing his nose into a wad of tissue while his wife tucked an airplane blanket around her shoulders and snuggled into her seat for a nap. "I was supposed to tail Black into the museum while you stayed outside. At the last minute, you changed the plan. I'd like to know why."

She did know how to cut straight to the chase, didn't she? "Because I saw Black's contact and you didn't, and there wasn't enough time to warn you." I thought about it a moment, then decided that straight truth was better than a polite lie. "Also, I couldn't trust you to be as discreet as I needed you to be."

"Uh-huh." She nodded and shoved the in-flight mag back in the seat pocket. "And that has something to do with the way I'm dressed."

"That's part of it, yes. It's hard to keep a close tail when you're dressed like a fashion model. I was afraid that either Black or Curly would spot you, so I cut in." She opened her mouth to object, but I raised a hand to cut her off. "But that's only half of it. I saw something that indicated to me that this wasn't going to be a simple letter drop."

"The magazine? Oh, c'mon . . . I noticed that, too."

The flight attendant picked that moment to stop by and inform us of tonight's dinner choices. I opted for the steak tips and Mickey requested the linguine, and I asked for another bloody mary. Two more cocktails on a full stomach, and I'd snooze through the rest of the trip home. When she was gone, I picked up the thread of the conversation. "I'm sure you noticed the magazine. It was an obvious giveaway . . . why would anyone carry reading material into an art museum? But I bet you were thinking that he would drop it somewhere, and someone else would pick it up later. Right?"

Mickey didn't say anything, but the look in her eyes told me that this had been her thought at the time. "But that wouldn't work," I continued, "because major museums are positively fanatic about their appearance. If Black had casually dropped it on a bench, you can bet that it wouldn't have remained there two minutes before a security guard would have picked it up and tossed it in a wastecan."

"Uh-huh." She raised an incredulous eyebrow. "And you figured that out immediately."

"No . . . or at least not immediately. It just seemed like an amateurish way of going about a letter drop, and we were clearly dealing with pros. And I ruled out a brush contact because there weren't enough people around. If you want to hand off something to someone, you do it in a crowded place, like an airport terminal, where there's so many people around that if anyone's watching . . ."

"I know what a brush contact is,

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thank you."

I had no doubt that she did; I had read her Mossad dossier shortly after she had been hired by Falcon Associates. Mickey was good. She had to be good, because the boss didn't bother with second-raters and washouts. But she was used to dealing with crazy Palestinian bomb-throwers, not the cooler variety of American industrial spy. "Sorry," I said. "Didn't mean to sound patronizing. I just don't think you would have tumbled onto Black's game if you had been looking for the obvious." I allowed myself a chuckle. "He's a sly kinda guy, our Mr. Black. If I had been one step behind him, he might have gotten away with it."

Mickey opened her mouth to ask the obvious next question, but again we were interrupted by the stewardess. She gave me a fresh bloody mary and handed Mickey her ginger ale, then quietly asked that I lower my window shade. Unnoticed by either of us, the in-flight movie had started; special-effects starships and Jedi masters were leaping across the narrow screen. I was almost tempted to curtail our chat and put on the headphones.

"The hair you found?" Mickey's manner had thawed a little; she was no longer irate so much as she was curious. "You didn't explain what . . ."

"Oh, right. The hair." I sipped my drink—still a bit too bland, and not enough vodka in it either—and put it aside. "Black's a biochemist who works at a major biotech firm, right? That means he has access to all sort of advanced technology, not the least of which the stuff they use for genetic research."

"I understand that. But what does that have to do with . . . ?"

"He needed to smuggle a lot of company information out of his lab, but he couldn't do so through ordinary means, right? So he borrowed a trick some researchers at Mt. Sinai University devised a few years ago as an experiment. He took the records he needed, coded them as a long DNA sequence, and transferred them to an organic medium . . . in this case, a strand of his own hair."

Her mouth dropped open as her eyes widened. "You can do this?"

"If you know what you're doing, sure. DNA is made up of a series of nucleotides, and geneticists code them by assigning them letters from the alphabet. Rearrange those nucleotides by their letter-codes and you've got a form of microscopic cryptography. All you have to do then is impress them on a medium . . . the Mt. Sinai scientists used the back of a postage stamp for their experiment . . . and you've got something like microdot. Only better, because it not only holds more information, but also because you have to know the genetic code they used in order to decipher the message. Sort of like shared-key computer encryption."

I found a new level of respect in Michaela's face as she stared at me. "How did you know about this?"

"I read about it in the *New York Times*." Which was only a half-truth. It was published in the *Times*, yes, and also in *Nature*, but I first heard about it in a classified memo which was circulated around the CIA shortly before I bailed out. "It's actually easy to do, if you know how. A seventeen-year-old girl from Long Island duplicated the same feat only a year later. Earned her a prize in a high school science contest."

Mickey was impressed. "Smart kid."

"Finding the message is only half the battle, of course. Once Jim locates it with an electron microscope, he'll still need to determine the exact nucleotide sequence which was used to encode the message. Once we've got Black under our thumb, though, he'll probably be willing to sing."

"If he doesn't give us the slip." Mickey frowned. "Your stunt with the flycam . . ."

"It tipped off his handler, sure. He may have already called Black and told

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him that they've been blown." I picked up the magazine from her lap and flipped through it. "It's more likely that Curly's probably going to let him twist in the wind while he catches the next flight to Italy. Black's tied down, though . . . wife, kids, a nice house, a career while it's still there. It's going to be harder for him to run, and that much easier for us to cut a deal once we catch up with him."

"I've seen it happen." She gave a little shrug as she sipped at her ginger ale. "My team once had to pursue a car-bomber all the way to Peru before we were able to make a collar."

She didn't say whether her people had made any sort of deal, but I rather suspected otherwise. I handed the magazine back to her. "This isn't the same thing. You're talking about state-sponsored terrorism. I'm talking about companies who hire professionals who, in turn, get poor slobs like Black to take the shitty end of the stick. It's a whole different ball game."

"I see. So you're implying that I'm not ready for his sort of thing." Mickey shoved the magazine into her seat pocket, then pulled out the packet containing her own headphones. "How very enlightening."

One step forward, two steps back. "I didn't say that. I was just trying to . . ."

"Thank you. I'll take your advice under consideration." Mickey withdrew the headphones from the bag, slipped them over her head, and inserted the plug into the audio socket beneath her armrest. Then she pushed back her seat and let herself be lured into a fantasy world where good and evil were clearly delineated, where justice was meted out with light sabers and laser guns.

After awhile, I joined her there. It wasn't a bad movie, if you wanted to escape from reality for awhile.■

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As humans adapt to new environments, they may adapt the very concept of adaptation. . . .

FRESH AIR

Brian Plante

I always hated being so different from my Mom and Dad when I was a kid. But what do kids know? Sometimes I thought I would rip off the stinking rubber and plastic breathing mask and gulp in their poisonous air just to spite them, to punish them for having made me this way. It wasn't until I was a lot older, though, that I realized just how much like my parents I really was. We all wanted, more than anything, to make things right for the next generation and give them a brighter future than we had. I guess that's an important trait for colonists.

I was eight years old and still wearing the breathing mask when my father told me he was dying. I remember the events leading up to that conversation as if it were yesterday. I suppose things had been building up for a while, but being the naïve kid that I was, I never noticed anything until that one day when it became all too clear that something was very wrong. Mom, Dad, my younger sister Serena, and I were seated at our little dinner table. My two youngest sisters, the twins, were in their baby bubbles in the single bedroom we all shared. Mom would feed them later, since there wasn't enough room in the small dining area of our cabin for the six of us at the same time.

We lived aboard the colony ship *John Chapman,* which had been grounded on the planet Urtanzia ten years earlier, but was still mostly intact. That's why my sisters and I had to wear the breathing masks. Mom and Dad, and all the adults, breathed different air than we kids did, and that's what they used for an atmosphere in the ship. Nearly all the kids my age and younger had to wear the masks to breathe on the ship. Only the kids who were conceived by a "happy accident" didn't have to wear one. Those of us who were planned had been engineered to be different from our folks.

My sister and I ate mostly liquid things back then. It was easier to drink "pureed everything" through a check-valve straw in the masks. There was a tiny airlock-like hatch built into the mask that you could pass small pieces of solid food through, but it took forever to eat that way, and the masks got really filthy. And nothing tasted very good with the tiny whiff of ship's disgusting air that came through the mini-airlock with every bite. I didn't know how Mom and Dad could stand to breathe that stuff.

Over the course of dinner I saw Mom looking at Serena and me and weeping. Sometimes she did that because of the masks. She hated them even more than we kids did. Sure they were uncomfortable, but we had been raised our whole lives with them, and it was all we had ever known. We mostly got used to Mom's crying, too, but this time it was a little different.

I wished then that I could rip the mask off and kiss her, really kiss her, like

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Dad did.

Dad got up and put his arms on Mom's shoulders, but then he started coughing. Not just little clear-your-throat coughs, but big wracking lung-busters. His coughing had been getting steadily worse lately, and I knew he had been seeing a doctor about it. One of his lungs was already plastic. A year earlier, Dad had a malignant tumor show up, and they had replaced the lung with an artificial one. Dad used to make jokes about it, saying he could blow out a candle from across the room with his bionic lung, but it had been a scary time when he went in for that operation. Fortunately, the medical staff on the *Chapman* was top notch, since keeping everyone healthy was a major priority for starting Colony City on Urtanzia.

When Dad's coughing subsided I asked him, "I'm not leaking, am I?"

I meant the air from my mask. The air every kid breathed in a mask had a lot of chlorine gas in it, and grown-ups like Mom and Dad couldn't tolerate too much of it, so we had to be careful about keeping the seals on the masks tight. My youngest sisters were still just infants, so they stayed inside their plastic baby bubbles instead of wearing the masks, but we older kids all had to be careful about preventing leaks.

"Are we going to tell them or aren't we?" my Mom said to Dad.

Dad patted Mom's shoulders and shook his head yes.

"How about going outside for a little walk, David?" Dad said to me.

"Sure," I said. I liked going outside on the surface. What kid didn't at that age?

"Me too, me too!" said Serena, jumping up.

Mom put up a hand to hold her back. "No, honey, Daddy wants to talk to David alone. Man talk. You stay home with me and help get the twins fed and we'll talk some."

"Oh, OK," Serena said, the disappointment obvious on her face.

As I tried to climb around Mom, she hugged me and planted a kiss on the resin faceplate of my breathing mask, leaving a pair of perfect lip prints. I reached up to wipe them away, but Mom started crying again, so I dropped my hands to my side and left them there while she hugged me. I could wipe it away when Dad and I got outside.

Dad grabbed his outside breathing mask from the rack by the door on our way out.

At the entrance to the airlock, Dad slipped his mask onto the crown of his head. It wasn't exactly the same kind of mask as we kids wore. The adult masks were bigger, obviously, but the seals were different and they had larger gas cylinders hanging off the bottom flange. I was glad I didn't have to wear anything that bulky.

It was just the two of us, Dad and me, inside the airlock. The inner door closed and the warning light came on. Instead of slipping his mask on like he was supposed to, Dad started hyperventilating, taking several deep breaths and then holding the last one. Then the cycle light came on and our clothing fluttered as the ship's air in the lock was replaced with outside air. Inside my mask, I tried holding my breath as long as possible, but I could never hold it as long as Dad.

As soon as the airlock door opened, I ripped off my mask and breathed the fresh outside air. Those first few breaths were always so wonderful after a whole day breathing the stale, canned air in a mask.

Dad was still holding his breath, turning a bit red in the face, and he motioned me to come closer. When I did, he put one hand on the top of my head, bent down and kissed me on the cheek. "My little man," he said in a croaking voice, being careful not to inhale the outside air. I loved my Dad, but I was glad none of the other kids were there to see him kiss me.

I smiled up at my Dad and pointed at the mask on top of his head. He nodded

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and finally pulled the thing down over his face and quickly adjusted the straps. Then he coughed for a couple of minutes after that, until he purged all the outside air from the mask and set the seals. It scared me to hear him coughing like that but soon he was OK, and we walked out of the ship and onto the surface of Urtanzia.

Immediately outside the door were a dozen or so grown-ups milling about, waiting for their kids to finish playing and come back inside. Off to one side of the hull was a playground, with climbing tubes and lever swings to play on. About twenty other kids—boys and girls—played there. Farther off in the distance was the growing skeleton of what would one day become the permanent Colony City.

I handed my mask over to Dad to hold, and was about to run off and join the other kids when he held me back.

"Before you go," he said, "we should have a little talk."

"About what?"

"Well, you know how I take good care of your Mom and sisters?"

"Uh-huh."

"Well, David, I'm going to need you to take over my job."

In his younger years, Dad had been a cargo specialist onboard the *Chapman*, but when the ship arrived on Urtanzia, he had become semi-retired. He helped out some with construction of the new Colony City, but most of that was done by robots, so his main purpose in life, same as all the other adult crew members, was making more colonists like my sisters and me.

"Your job?" I said, puzzled.

"Yes. You're going to be the man of the family soon, and I want you to take good care of your Mom and your sisters. It's a very important job."

I was just a dumb kid, so it didn't hit me right away what he was trying to say. I started edging away from him towards the playground and the other kids, not really wanting to hear him explain any more.

"Are you . . . going somewhere?" I asked, my voice cracking.

"In a way."

His eyes looked watery through the mask's faceplate, and I figured wherever he was going was not a good place.

"It's the cancer," he said. "When they replaced my lung, the doctors thought they got it all, but it's come back."

A wave of fear washed over me, and I recognized it as the same fear I had experienced when Dad went in for his first operation.

"Um, is that why you cough a lot?" I asked.

"Yes, son."

"Well, why don't they just change your other lung and fix it like the first one?"

"It's not that easy, David. The cancer has spread to a bunch of other places. They might be able to fix it if they replaced just about *everything* on me, but my odds would still be fairly low, and really, we don't want to squander all the medical supplies on hopeless cases like me. I'm getting a bit too old for breeding stock anyway, so my real purpose here is done. It's better to save what's left to help get you kids off to a good start."

I had a dark thought—all the times my sister and I had accidentally leaked mask-air into our home and how it had made Dad cough.

"Was the cancer caused by mask-air?" I asked, afraid of the answer.

"No, no, don't even think of it for a second. Cancer is just something that happens sometimes. It's been around since long before there were colony ships or kids' breathing masks. The doctors have been able to cure most types of it, but cancer isn't just one single disease, it's a big, grim family, and it mutates all the time. The one I have is a new type, and they don't have anything that works well enough to control it."

I didn't much like doctors back then. Dad had explained how it was doctors that had made me and all the other kids

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need the breathing masks. Mom and Dad always said how that was a *good* thing, but when I was a kid, I just wanted to be normal, like them.

"Dad, if the doctors engineered me and the other kids to breathe outside air, how come they can't engineer you to not have cancer?"

"It's all a matter of timing, I'm afraid," Dad said. His faceplate was fogging up a bit. "The genetic engineering has to be done before you're born, when you're just a tiny zygote. Before the cells start differentiating."

I didn't know at the time what a zygote was or what differentiation meant, but I nodded my head like I understood. And I started crying.

"If we went back to Earth, could they fix the cancer there?" I asked.

"Even if I lived to be an old man, we wouldn't get to Earth in my lifetime, or yours either. Coming to Urtanzia was always planned as a one-way trip, and my generation's job was just to help get you kids started here. So, you see, my job is done, and I've had a pretty successful life. You and your sisters were my great achievement. You just take care of your Mom and sisters for me, so it doesn't all go to waste. And one other thing I want you to do for me."

"W-w-what's that?" I was glad I wasn't wearing the mask, since I had to wipe my eyes.

"You know that thing I do in the airlock sometimes?"

"The kissy thing?"

"That's it. Try holding your breath. Practice. When you can hold it for a couple of minutes, I want you to plant one on your Mom. She hasn't held you without a mask or a baby bubble separating the two of you since you were born. A mother should be able to kiss her son without some plastic between them."

"Um, I'll try."

"Now go off and play with your friends."

I didn't feel much like playing then, and didn't want the other kids to see me crying. I held on to Dad tightly.

"No," he said, pointing to the playground, "your future's with them. Go off and play now."

I kept wanting to turn back, but Dad shooed me off and I played with the other kids. But I didn't have fun.

Soon after that, I began practicing holding my breath.

Twenty years later saw a big change on Urtanzia. My father had long since been dead from the cancer. I had more sisters and brothers, since Mom had several more even after Dad was gone, using his frozen sperm. My sisters and all the other kids I used to play with had grown up and moved out of the ship, and Colony City had blossomed into a *real* city. Mom and all the other remaining starfarers of her generation were still living in the old hull of the *John Chapman*, and would remain there until old age took them. It was sad that they spent their entire lives in that tin bucket, but that's how they always planned it.

In the intervening years, I had become a genetic engineer, hoping to improve on the kind of manipulations that had allowed my generation to walk on the surface of Urtanzia without a breathing mask and inhale fresh planet's air without choking. And I had married Dora, one of the girls I used to play with at the playground on those outings with Dad.

It must have been a hard choice for my parents' generation to have us kids engineered to be so different from them, to have children whose cheeks they couldn't kiss without a mask intervening. Dora and I were just starting our own family, so as parents we could understand how tough it must have been. Shortly after leaving the maternity ward of the Colony City hospital, we took our firstborn child, a son, to my Mom's cabin in the *Chapman* for a first visit. Dora and I stood outside the hatch door, looking at each other through our masks and holding the baby as we waited for Mom,

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now Grandma, to let us in.

In the years after Dad had died, Mom had become lonely and sad, and after all this time she had never fully gotten over him. Dora and I hoped the sight of her firstborn grandchild would cheer her up. She opened the door and waved us into the cramped quarters, walking a bit slowly. Dora, still sore from the delivery, also walked stiffly.

Through the mask, Mom kissed me, and Dora made a face when I reached up to wipe the lip prints off my faceplate. And then we handed over the wrapped bundle that was our baby son to Mom, to fawn over her new grandson. When Mom lifted off the covering she nearly fainted.

Our son wasn't inside a baby bubble. No mask.

"I worked on his genetics myself," I explained to Mom. "He can breath air from Urtanzia or Earth, although he'll be a bit more comfortable here on Urtanzia. And one day, maybe *his* grandchildren will visit Earth, and breathe the air there without a mask."

Mom kissed the baby, baptizing him with tears of joy. I took a couple of deep breaths and held the last one, purging the chlorine from inside my breathing mask. While Mom was occupied with her grandson, I slipped the thing off and bent down to kiss them both. For Dad. And me. And a future where a grandmother can cuddle her grandchild, cheek to cheek, and share a breath of fresh air between them. ■

IN TIMES TO COME

Science fiction readers are familiar with Sir Arthur C. Clarke's observation that "Any sufficiently advanced technology is indistinguishable from magic," which is directly pertinent to our lead novella for March: Bud Sparhawk's "Magic's Price," with a dramatic cover by George Krauter. All Clarke's indistinguishability requires is sufficient distance between two levels of technology, each of which may be anywhere on a long, sliding scale. An ambitious young person on the lower of such a pair of levels may well jump at a chance to rise to the upper—but he won't see it as "advanced technology," and he will, as the title suggests, have to pay a price. . . .

We'll also have stories by Edward M. Lerner (continuing the series launched with his popular "Dangling Conversations"), J. Brian Clarke, Pauline Ashwell, and Brian Stableford. William Sims Bainbridge, Ph.D., supplies an unusual and provocative fact article: another of his statistical surveys, this time looking at "The Poverty of Nations." There's a cliché popular in some circles that the "rich" nations are ruthlessly exploiting the "poor"—but is it really that simple? Hint: consider the question, would the poor nations be better or worse off if the rich had never existed? Influences flow both ways, and are seldom as clear-cut as crusaders of *any* stripe would have us believe!

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THE ALTERNATE VIEW Jeffery D. Kooistra

IN REPLY TO MR. TOM FIELDER

Dear Mr. Fielder,

I enjoyed reading your letter in the Brass Tacks section of the September 2000 *Analog*. I had been trying to decide amongst many choices just what to write about this time around, but your letter set me off on a thought train, the result of which is the column you're reading now. Since you mentioned that it's usually a toss-up as to whether or not you read Stan's editorial or my column first, I hope this month's title sufficed to flip the coin in my favor.

And now, to the specifics of your letter.

You say that in my column "Aether One or the Other" (from the March 2000 *Analog*) I "skewer[ed] yet another supposedly solid fact from [your] college physics course, namely the result of the Michelson-Morley experiment." I need to correct you on this point since I didn't skewer the *result*, but only the relevance of the result to questions about the existence of the aether. The result was a null, and since this result is consistent with both Special Relativity and a rather large subset of the set of aether theories, it is not an experimental result one may logically cite as a refutation of the existence of an aether. (I'm sure you actually already understand this, but for the sake of readers who may not have read either my column or your letter, I put it in here.)

You go on to quote me where I said, "It's been shown many times that the Michelson-Morley experiment was inherently null in design," then go on to ask who has shown this and if it's been done so many times, how come you haven't heard about it. One purpose of this column is to try to answer that question for you, though not by giving you lots of references (though I will supply some), but by explaining why simply citing references is sometimes insufficient.

As you yourself note in your letter, "A number of references were included in this article (sigh, more reading I don't have time for)." Well, there you go—how many references should I have included? I only have about 2000 words per column, and if you don't have time to read anyway . . . . I specifically left out a reference to the "inherent nulls" of the M-M experiment for three reasons. (1) Since the result was a null, it doesn't *support* the existence of an aether, either, but I brought it up because so many people have been taught (and continue to be taught) wrongly about its significance. (2) For those who are really interested in the question, it is relatively easy to find information about the issue. Start searching the web on the word "aether" or "Michelson-Morley" and it won't be too long before you find your way to material that explains that not only was the M-M experiment inherently null, but that other experiments apparently *have* shown the existence of an aether, including the Michelson-Gale experiment. (But bear in

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mind—web searches are a mixed bag—you'll also find lots of lecture notes and whatnot that echo the usual story, and also "aether-apologist" screeds which are hopelessly unscientific.) (3) There's no such thing as one good reference. One reference is like pointing with your finger at something you want your dog to look at—your dog looks at the finger instead. One reference can always be "refuted" by another, but how many need to be supplied to carry the day? Since the article wasn't about the M-M experiment, I didn't load up on references for that.

I got the impression from your letter, rightly or wrongly, that you kind of thought that if someone showed once that the M-M experiment was inherently null, this would be trumpeted in the literature. Unfortunately, this isn't how it went. It's more like a front page headline proclaiming **CONGRESSMAN ACCUSED OF TAKING BRIBE**, followed a month later on page 20 a small piece entitled Bribe accusation lacks evidence, and after that opinion remains mixed about the congressman. In other words, the M-M experiment only makes a good story when the unexpected null result is thought to mean that a previously cherished idea, that of the aether, has to be thrown out. When it is later shown that the null result should have been expected this draws little attention, particularly when Special Relativity seems to have been verified on the basis of other experiments.

Still, if you want some references to look for, you might try Rindler's *Essential Relativity*, where on page 7 he says: "For a while the Lorentz theory provided an alternative to Einstein's theory, equivalent to it observationally and less jolting to classical prejudices." Also: "Though apparently based on a preferred ether frame, the Lorentz theory yields symmetry, as far as observable predictions go, between all inertial frames." In other words, both Einstein's idea and Lorentz's ether predicted the same null result. (Why does Rindler mention this when others don't? Well, Rindler wrote a paper on the Lorentzian ether theory, and so brought it up in his relativity book.) If you want more current discussions of these issues, you can find them in journals such as *Galilean Electrodynamics* and *Apieron*. Two books that are absolutely essential for sorting out the facts about aether theory and electrodynamics are Whittaker's *A History of the Theories of Aether and Electricity*, and O'Rahilly's *Electromagnetic Theory: A Critical Examination of Fundamentals*. Unfortunately, neither of these is all that easy to come by. A very good college library may have both (most have neither), but trying to buy your own copies is very difficult. Note that O'Rahilly's book came out in 1938. I don't know how old you are, but the irrelevancy of the null result of the M-M experiment to refuting the existence of an aether has been pointed out since before most *Analog* readers were born. Still, if you want a specific quote you can check on if you ever come across a copy of O'Rahilly, here's one from page 440: "So when Lorentz and Einstein, with the aid of good algebra and bad metaphysics, finally arrive at equations identical with those of Stokes, as regards the M-M experiment, their theory is *scientifically* indistinguishable from that of an earth-convected aether."

Trying to answer your question about why you haven't heard about it is both easy and difficult. The easy answer is that you haven't heard about it because you haven't gone looking for it. The hard answer involves trying to figure out why people who should have heard about it, like those who write our textbooks, haven't heard of it either. My only answer to that is that they don't know there's anything to go looking for. For instance, if one consults *The Mathematical Theory of Electricity and Magnetism* by Sir James Jeans (the 5th edition from 1925), on page 593

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one finds Jeans saying: "Finally it became established that the ether, if one existed at all, could not share in the motion of moving bodies; it must be stagnant, and moving bodies must simply move through it without setting up mass-motions in it." If what Jeans says is true, then it *would* be the case that the M-M experiment, by refuting the existence of a stationary aether, would have refuted the aether idea in general since Earth-convected aether theories were supposedly ruled out on the basis of other experiments. Only someone devoted to the subject would eventually come across Rindler's mention of the Lorentzian ether, and O'Rahilly and be shown, in excruciating detail, where Jeans and others were in error.

I'll be honest with you—I had to slog through an awful lot of crap, some of it written by otherwise superlative scientists, to find my way to the good stuff. And of course, most of the crap is written by people who are not good scientists. O'Rahilly and Whittaker are butt-munchingly thorough in their analyses, and neither one of them is what I'd call an "aether advocate." O'Rahilly points out that the equations of electrodynamics used by "the relativists" are identical to the equations used for an Earth-convected aether not because he wanted to argue that there is an aether, but because he was fed up with all the metaphysical mishmash relativists were attaching to identical sets of equations.

Near the end of your letter you say: "However, it always seems to be the most outrageous or annoying statements (and I mean that in a good sense) that are left unsupported, like that offhand remark near the end regarding Feynman's statement that electrodynamics isn't self-consistent." In this specific case, I'll admit that the statement is annoying, but how "outrageous" can it be if Feynman, widely recognized as one of the true giants of physics this (er, last) century (that's why I like to quote him) said it?

Without further ado, let's go to *The Feynman Lectures on Physics*, volume II, page 28-1 (The way the pages are numbered in the lecture series is to put the chapter number first, then the page number of the chapter. Hence, 28-1 is the first page of chapter 28.). In the first paragraph Feynman says: "Classical mechanics is a mathematically consistent theory; it just doesn't agree with experience. It is interesting, though, that the classical theory of electromagnetism is an unsatisfactory theory all by itself. There are difficulties associated with the *ideas* of Maxwell's theory which are not solved by and not directly associated with quantum mechanics. You may say, 'Perhaps there's no use worrying about these difficulties. Since the quantum mechanics is going to change the laws of electrodynamics, we should wait to see what difficulties there are after the modification.' However, when electromagnetism is joined to quantum mechanics, the difficulties remain."

After ten pages or so of explaining where the difficulties lie, Feynman says on page 28-10 : "But the difficulties do not disappear in quantum electrodynamics. That is one of the reasons that people have spent so much effort trying to straighten out the classical difficulties, hoping that if they *could* straighten out the classical difficulty and *then* make the quantum modifications, everything would be straightened out. The Maxwell theory still has the difficulties after the quantum mechanics modifications are made."

In my experience, Feynman's comments are particularly annoying to engineers who seem to be under the illusion that just because Maxwell's equations work so well in so many cases, everything must be hunky-dory (they also get upset when they find out that Newton's third law is violated in classical E&M—OK, OK, pages 17-6 and

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27-11). But most physicists aren't any happier and are usually also unaware of the foundational problems. Feynman says: " . . . people have spent so much effort . . ." You might ask of Feynman, Mr. Fielder, if this is so, who are these people and why haven't you heard about it?

Seriously, thanks for the letter—it gave me a chance to make some points that needed to be made. I don't know what other reading you're doing, but I'd like to point out to both you and my other readers that in terms of readability, availability, and absolute value—in general, simple bang-for-the-buck, there is no better resource for the layman or the professional to brush up on physics than the Feynman lecture series.

Best,
Jeffery D. Kooistra
■

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Or Die Trying

Grey Rollins

Not many detectives get the chance to investigate their own murder!

Money bends morals the way the wind bends trees. That pliability, that flexure in the moral fiber of my fellow man, keeps me employed. I investigate claims for an insurance company.

I remember the first time I met Milton Dantzler, my boss. I left his office convinced that he'd been borrowed from a wax museum, so little had he moved. In the six years since, I had never seen him move out of his chair. I'd never seen him move much in it, either. Every time I reported in, I half-expected to find a thin film of dust covering the tops of his shoulders, but the janitor seemed to keep him spotless, just like the rest of his office.

Dantzler sat regarding me impassively as I fell into the visitor's seat. Some childish part of me always wanted to emphasize my movements, as though to make up for his lack of motion.

"So what is it this time?" I asked.

His marmoreal face held less expression than the surface of his desk. "Someone is dead. The odd thing about this . . . ah, death is that it occurred after the victim had died."

Not as much of a riddle as it first sounded. "He died. His personality was read into the system, but before it could be read back into a cloned body, somebody wiped his patterns."

Dantzler's nearly colorless eyes glittered. "Precisely."

"I thought the system was redundant."

"It failed."

I nodded slowly. "And the dead man had an insurance policy—"

"A rather large one."

"—that we'd rather not pay."

"If he was murdered, we stand to pay out a substantial sum of money. If it was due to an equipment failure," Dantzler blinked and smiled a wintery smile—coming from him, this was a veritable torrent of expression, "then that is not, strictly speaking, covered by his policy, and we will offer only condolences to his widow."

Milton Dantzler had a cold, steel bank vault where his heart should have been.

Ray Chernoff had been shot coming out of a restaurant on Hectler Street. A patron at the restaurant had kept his wits and dragged Chernoff's bullet-riddled body into the doc-in-a-box just inside the door. Chernoff had lived long enough for his personality to be successfully read into the computer net. Had things progressed normally, a clone would have been forced to maturity, and Chernoff

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would have been read into his new body, an even better insurance risk than before he was killed, since clones are guaranteed to be free of cancer, disease, and the like at the time that the brain is programmed with the personality. He would have been ready to go on, living a happy, productive life, paying insurance premiums and making the company very happy.

Unfortunately, it didn't work out that way.

The master copy of someone's personality resides on a solid-state memory chip. There are two other copies as backups, just in case. When the time came to reincarnate Chernoff, they found that all three had been destroyed.

Had it been due to a freak equipment failure or had someone deliberately wiped Ray Chernoff out? It was going to take something slick to prove whether his death—meaning his second, electronic one—was intentional or otherwise. I spent the evening mulling over the problem, hoping to find some clever way to approach the job. To help lubricate my thought processes, I got out a bottle of Scotch. By the time I went to bed, I had done rather more drinking than thinking, and the floor and the ceiling kept swapping places. The walls were there when I needed them, but they kept weaving. I couldn't get them to understand that my dance card was full.

The next morning dawned earlier than I would have wished. My toothpaste tasted overly bright and cheerful. When I opened the refrigerator, the shelves looked more appetizing than the food.

The doorbell rang.

Just what I needed. Sensory overload at a quarter till seven.

I opened the door to find a pale, skinny young man standing in the hallway. "You Sawyer?" he asked.

I took a deep breath, willing my head to quit pounding. It didn't work. "Jack Sawyer, yes."

He squinted at me. "You don't look so good."

"That's not surprising. I'm dead on my feet."

He gave me an insolent grin, pausing for melodramatic effect. "That you are, my friend," he said, reaching under his leather jacket.

My reactions were much too slow. I dropped, pivoting, but he deftly stepped inside my kick, countering, and suddenly I was sprawled on the carpet just inside my door. He stepped inside, gently closed the door, then slid a silenced Markia from the back of his waistband.

The first shot shattered my right kneecap. The second split my left in half. That would have been enough to render any normal man defenseless, but the grinning boy with the gun methodically shot both of my hands through the palms.

Leaning down, he grabbed my shirt collar and dragged me down the short hallway to the doc-in-a-box outside the bathroom. Smeared, undulating trails of blood traced my path. Unceremoniously dumping me on the floor, he pried open the door. "Wanna live?" he demanded.

I was drowning in more pain than I had imagined existed in the entire universe. Rhetorical questions were more than I could cope with at the moment.

He grabbed the front of my shirt, shaking me violently. My knee bounced off the baseboard and a wave of nausea rolled over me. *"Wanna live?"*

I ground out an answer though gritted teeth. "Yes."

The idiot's smile vanished, to be replaced by an expression of unconcern. "Maybe," he tossed off nonchalantly.

I tried to flex the fingers of my right hand and was rewarded with electric bolts of pain. The middle finger had not moved—part of the tendon was probably still on the carpet in the living room—but the others seemed to work. Something in my left hand grated when I tried to move it. I began weighing my chances of taking this leering punk. Whatever I did, it would have to be with

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my hands only, my legs would not support my weight. Some small part of my mind was yearning for a time, three minutes and a lifetime ago, when my worst problem was a hangover.

My antagonist's mouth twisted. "You want to get in that thing?"

Why the devil would a murderer give a victim a chance to live again? Especially knowing the first thing he would do upon regaining his voice would be to give the police a full description of his assailant.

"You gonna answer me?" he demanded, suddenly agitated. His eyes were jumping, back and forth, back and forth. Like nervous marbles, they were. Drugs?

"Yes."

"Yes, what?"

"The box. Help me in." I tried to swallow, but my throat wasn't working right.

"Say please."

"Please."

"Say pretty please," he said, in a mocking, soft lilt.

The word sadist floated to the top of my mind.

"Say it!"

"Pretty please," I whispered.

"Louder!"

"Pretty please," I croaked.

"'Kay." He planted his foot in the middle of my chest and shoved, hard. I fell backwards at an angle into the doc-in-a-box, banging the back of my head against the lip of the seat. Compared to the pain in my hands and knees, it was hardly worth noticing.

Grinning boy kicked my feet inside. "See ya later, old man." He slammed the door shut and stood watching me through the glass.

Boxes are a little larger than a telephone booth, with a fair amount of innate intelligence. When mine smelled blood, it immediately began sprouting probes. It took only seconds for it to come to the conclusion that I had more serious problems than a paper cut. A transfusion line snaked down to where I slumped against the wall. Somewhere in its innards, it began placing a call to the nearest hospital.

I slowly raised my eyes, expecting the boy with the gun to bore a hole in my head with a 9 millimeter drill bit. He just stood there, watching. The grin was gone. He just looked . . . vacant. Like a rundown building in a bad neighborhood with weeds in the side lot and broken-out windows.

Gently, almost so lightly I didn't notice, a cap descended on my scalp. The chill from the supercooled SQUIDS seeped through the insulation into my brain. There was no other sensation. Silently, I urged the box to work faster, not knowing when the cat and mouse game would end.

I looked up into the muzzle of the Markia just as his finger tightened on the trigger.

"Good-bye," he said, his voice muffled through the glass.

A green light winked on. My mind had been successfully read into the net.

The gun spat.

When I woke up, I couldn't feel my legs.

Unreasoning panic rampaged through my mind and rational thought fled at the sight of the barbarians. Oh, Christ, my frigging legs have been amputated! It was a measure of how disoriented I was that it took about three seconds less than forever for me to notice that I couldn't feel anything else, either. No arms, no legs, no shattered hands. Nothing. It was as though my body had ceased to exist.

Bullets to the brain have that effect.

But the only reason I should have regained consciousness was if I had been read into my cloned body, ready to resume life among the corporeal. So why couldn't I feel my new body?

My mind reasserted itself, rationalizing, smoothing the wrinkles in my emotions. Perhaps I was anesthetized. Not ever having been through the actual process, I wasn't familiar with the procedures. Maybe they—

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And God said, "Better now?"

I flinched. That voice was all over me. Under my skin. Inside where I imagined my skull to be. Massaging my eyebrows. Between my shoulder blades like an itch I couldn't scratch, and wouldn't have dared try, even if I could.

"Not everyone gets a chance like this, you know," God said.

Something bothered me about that voice. It sounded too . . . mortal. God should speak in great, rolling, sonorous Gothic letters the size of skyscrapers. This voice was only the size of a house, or thereabouts.

"Who are you?" I tried to ask, but my voice caromed off the walls of the universe and reflected back through me like a heat wave. Too loud. *Way* too loud. I'd never been able to make that much racket in my life.

A dry, oh so dry, chuckle, like autumn leaves rustling in the wind. "Haven't you figured that out yet?"

Wait a minute. *"Dantzler?"*

"So. Your mind still works. I was beginning to worry. You're still in the computer net, Sawyer—and you're in front of me. Where you begin every assignment."

"Every . . . assignment?"

"Unless you've got another job lined up. Surely, you weren't going to hand in your resignation today."

What a comedian. "No."

"Here is the situation. You haven't enough money to pay for a body, so, at present, you cannot get out of the system. Two options remain. The first is that you can go quietly back to sleep in your chip. Unfortunately, that's a dead end street. It's comparatively inexpensive, but it isn't free, and they will erase your personality when your money runs out. Your other option is to be reincarnated within the system. As you might imagine, that's quite a bit more expensive, so your money will run out more quickly. But at least that way, you have the chance to earn enough to get reincarnated in a body."

"But how am I supposed to earn enough to get reincarnated if I'm burning money as fast as I'm making it?"

"Work fast. Work hard. Work smart. Call it an incentive plan, Sawyer. Your time is running out."

Suppose you were set on an unknown street corner in an unfamiliar city. Deaf, blind, and dumb, of course. And told to make it to the bank, the grocery store, and back to your current location. You have twenty minutes.

Not a comforting scenario.

I hadn't been able to see Dantzler during our call. I needed practice dealing with the system. Call home, I commanded. Hordes, armies, legions of electrons rushed forth to do my bidding. It tickled, like champagne bubbles flowing from my fingertips.

"This is Jack," my answering machine began. "If you're trying to sell me something, go to hell. All others leave a message after the tone." As I listened to my recorded voice drone on, I tried to access the video. My first few attempts failed. Finally, I got the familiar blue screen with white letters, displaying the text equivalent of my recording. I gave the code to replay messages, and the video switched to the camera at the terminal. "This is Chris with National Vinyl Siding. Sorry I couldn't catch you at home. If you're tired of painting your house, give me a call at—"

Chris, you're an idiot. I live in a concrete apartment building. Get a life, sweetheart. Then go to hell, like it says on the machine. I was so irritated with Chris and her inane rehearsed sales spiel that what I was seeing took a while to register. My apartment was empty. Devoid of furniture. Bare to the walls. Through some oversight, the message in my computer hadn't been changed yet.

As far as my landlord was concerned, not only was I dead, I wasn't coming back.

It did not take long to find that, like my apartment, the rest of my life had ceased to exist. My bank account, my library

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card, and my charge account at the X-rated video rental outlet had all been closed out. Why?

In my mind's eye, I saw the swollen end of the silencer, and beyond that, a face. The skinny kid with the gun didn't look like the kind to pick a name out of the phone book. He'd been told to kill me. By whom, and why? And why let my doc-in-a-box read my personality before administering the *coup de grace?* It made no sense.

Questions multiplied faster than reflections in a hall of mirrors.

I needed traction. Back to first principles. Start by finding out the date. All my life I'd been conditioned to think that sleep came in night-long doses. Ergo, if I woke up, I'd only been asleep since last night. Now, as they had for Rip Van Winkle, the teeth had all been stripped from the gears of my sleep mechanism and there was no telling how many times the wheels had turned.

Only two days had passed since my body's death. They had not passed uneventfully. My grinning boy with the silenced Markia had ended up as a statistic himself. Within hours of my death, he had slammed into the concrete in front of a sidewalk newsstand on Franklin Avenue. The roof of the building was thirty stories above; the wind of his passage had caused the top copies of magazines to flutter open, pages riffling.

Blood tests had found him to be a walking pharmacy. It wasn't known whether he had committed suicide, or had simply thought that gravity no longer held him to this Earth and tried to fly. I found both theories unlikely.

I needed to know his name. Eighteen or twenty years ago he had been the twinkle in his daddy's eye. The mother who had carried him for nine months would not have left him to wander nameless through this world. The news article I located in the online part of the library said he cracked the concrete wearing only clothing—no wallet, no cards, nothing else. The Markia had not been on his body at the end of his parabolic arc off the top of the building. The police, not knowing that he was a murderer, were not going to make it their top priority to identify a solitary junkie who decided to take his swan-song swan-dive off a tall building in the business district. Granted, it had been rather gauche to do so at midmorning for all to see, but, hey, when you gotta go, you gotta go, and that's one less hopped-up kid on the street, and let's get on to the next thing. Life moves. Pass the doughnuts.

My take was that he had been pushed over the edge, in more ways than one. He'd been given enough drugs so that the irrationality of allowing a man to be safely read into the system before killing him didn't make an impression. He'd popped me just before seven, made his way uptown to the rooftop for his payoff at about nine, then been taken out himself so as to distance those who had ordered the killing from the dirty hands.

Fine. Great theorizing, Sawyer. Now show me the evidence to back it up. And while you're at it, how about a few names to put under the mug shots. And, now that grinning boy is now out of the picture, your theory requires another murderer—the one who sent the boy over the edge, pants legs flapping in the wind. Find him. Name him.

And do it fast. Someway, somehow, I had to do all this before my time ran out, or die trying.

I found nothing that indicated whether Chernoff's personality had been fried on purpose. What the hell did Dantzler expect me to find, anyway? Fingerprints? A smoking gun?

Unexpectedly, grinning boy broke the logjam for me. I had been on the verge of giving up and reporting in to Dantzler, empty-handed, when it occurred to me to check the missing persons file at the police station. It was public domain, just like pictures of missing kids on milk cartons. John Q. Public did manage to find

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things out, once in a long while.

The morning after grinning boy failed to sprout wings, a girl named Leann Trane had called the Highway Patrol to see if her boyfriend had been in an accident. He had not come home after work, and had not called. She was worried. His name: Vincent Laws. He was seventeen. The picture was blurred, but it was good enough for me. Apparently, the cops hadn't yet gotten around to comparing the picture with the body at the morgue.

Once I had a name, things started clicking for me.

Vincent Laws had worked for a wholesale distributor, Collaro and Sons, on the blue-collar side of town. A little investigation into the business produced the interesting tidbit that Ray Chernoff had been employed by the same people, although at a different locale.

That I had been killed by someone who worked for Collaro was a little too big of a coincidence to swallow. Less than twenty-four hours had elapsed between Dantzler giving me my assignment and Laws showing up at my door. Someone knew, almost instantly, that I had been put on the Chernoff case. The inescapable corollary was that Collaro and Sons had someone at the insurance company.

I took a few moments and looked up the agent who had signed Chernoff up for his policy. His name was Paul Hammer. I'd met him, but he hadn't made any particular impression on me at the time. I might have to rectify that, but for the time being, I wanted to get back to Laws and Chernoff.

Suppose the wholesale business was a front for some as yet unspecified illegal activity. Suppose Chernoff threatened to go to the police with details, or walked home with some money that didn't belong to him. Bang, bang . . . no Chernoff. I, an unwanted busybody, was killed as a damage-control measure. Then Laws was killed as a cutout.

Of course, unlike Chernoff and Laws, I wasn't completely dead yet, but . . . but if the bad guys really wanted me dead and Laws had bungled the job the first time, then I was as good as gone. Like Chernoff, I was vulnerable. The electronic equivalent of cold chills zipped though me. Ripples of quantum mechanical shivers.

Microseconds passed as I sped to check on my backups. The first one was gone. Utterly. As though it had never existed. The other? Corrupted. A scrambled mish-mash of bits and bytes my own mother wouldn't recognize. It's one thing to be carnal and know that someone is trying to kill you—at least you can fight back—but it's another to be helpless, waiting for a crackling rush of electrons to burn you like a weed caught by wildfire.

The Grim Reaper was coming, and I had nowhere to hide.

I was unable to think of a way to run. The best I could come up with was to use copies of myself to leapfrog through the network. But to where?

Silly advice bubbled to the surface of my mind: when things look bad, bury yourself in your work. Work. Insurance companies had huge amounts of storage space. I could even set a program to monitor my file. If anything happened, it would tell Dantzler. I might not survive, but at least I wouldn't vanish without a trace.

Speaking of Dantzler . . . .

"Yes, Sawyer? Do you have something for me?"

"Reports of my death have not been exaggerated."

His face, expressionless, stared at the screen. I didn't know what he was seeing—there was no physical face on my end and no camera, either. "You're just now catching on to the fact that you're dead?"

"I just got the same treatment that Chernoff got. They zapped all three of my copies."

That got a reaction. His arched brow was the equal of full-blown hysterics in a

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normal person. "Then how—"

"I got out just in time. I'm here in the computer at work."

Dantzler's eyebrows tried to touch ends, furrowing the smooth skin between. "And who might *they* be?"

"I'm working on that. Look, there may be a leak."

"A leak?"

"They know what we're doing as soon as we do it. It's possible that Paul Hammer may be their contact."

Dantzler's brows relaxed. His face resumed its imitation of a statue. "Paul. I see." He nodded millimetrically. "And Collaro?"

"Nothing solid yet," I cautioned. "Just circumstantial evidence, but I think I can tie this up pretty quickly. Now, about my pay. If you don't mind, I'd like to get my money and get a clone started. I've done about all I can in here."

"Here I must confess to a minor distortion of the facts. As you may recall, I told you that you didn't have quite enough money to pay for a clone. That wasn't exactly true. As soon as I heard of your death, your body's death, that is, I told them to start a body for you. It drained your account, but you had enough."

Lacking eyebrows, I couldn't scowl. A peculiar kind of frustration came over me at not being able to express myself physically. "So why tell me I didn't have enough?"

"I felt that you needed some incentive to investigate. If I had told you that a body was already growing, you would have gone inactive in order to save money. As it is, the company is paying for your incarnation within the network."

"How long before my new body is ready?"

"Friday. Two more days. Honestly, I hadn't expected you to produce results this quickly. You've . . . ah, exceeded my expectations."

I didn't know whether to feel smug or insulted. "Okay, see you then," I told him, and broke the connection. I had a few loose ends to tie up, so I didn't go dormant. If the company didn't like it, we could discuss it face-to-face on Friday.

I walked into Dantzler's office late Friday afternoon—his last appointment of the day—enjoying every step. There is a sensuous pleasure in making your body move that I had never noticed before. In the past I'd always rather thought of myself as a little guy sitting in a control room two inches behind my eyes and midway between my ears. My body was nothing more than a robot run from a control panel. No longer. Animal sensations of blood coursing through my veins, muscles sliding beneath new, smooth, supple, unscarred skin. My sense of smell . . . aromas unfolded in layers, revealing delicate secrets I had never guessed existed.

I couldn't wait to find a woman.

Instead of my usual falling-bridge collapse into Dantzler's chair, I slid in. Leopards were clumsy beasts compared to me.

He looked up at me with the barest hint of a quizzical look. Perhaps it was my quiet entry. For all I knew, this new body had an aura. I was ready to test Shaw's assertion that youth is wasted on the young. I had been granted a fresh body. I had no intention of wasting the opportunity.

"So. You have returned," he uttered, lips barely moving.

I nodded slowly. "I lived. In spite of a last-minute attempt to get me."

His eyebrow twitched.

"It was most interesting. You see, as far as they were concerned, I was dead. If I was dead, then why a sudden, directed effort to kill me again? Curiously, they knew exactly where I was, here in the system. I thought about Hammer—"

Dantzler nodded. The smallest gesture at an rare art auction would seem the wildest gesticulation by comparison. "Ah, yes . . . Hammer. I've had my eye on him since you—"

"But it wasn't Hammer."

The eyebrow again, but a little more

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expressive this time. "Really?"

I smiled. "Once, long ago, there was an ambitious young insurance agent by the name of Milton Dantzler. He was dating a spectacularly beautiful young woman by the name of Marie Collaro. Ernesto Collaro's younger sister, as it happened. Well, things happened in the business world and Ernesto's fledgling wholesale business was burned out. Arson, most likely. Probably a would-be competitor, but at this late date, it's hard to be sure of these things. Anyway . . ." I stopped and looked at him. "I'm sorry, am I boring you?"

His eyes had narrowed to mere slits, an expression that I had not known was in his repertoire. "No, this is most interesting, I assure you. Please continue."

I nodded. "A deal was struck. A policy was faked—written as though it had been completed two or three days before the fire. The company squawked, but paid. *Presto!* Ernesto had the capital to make a fresh start. Milton Dantzler, in return, got a great deal of business funneled through him, which made him a successful agent, indeed. Promotions followed and he became the head of the investigation unit, which is where he could do Collaro the most good. After all, this is where cases are really decided."

"There are holes in that concoction that you could throw a dog through," Dantzler spat.

I ignored him. "Milton Dantzler proposed to Marie Collaro and they were married on June 10. Six months later, she was in a accident which left her face badly scarred. She grew despondent, believing that her husband no longer loved her. On their first anniversary, she sat on the edge of their bed, placed the barrel of a gun in her mouth and—"

"No!" Dantzler screamed, his knuckles white on the arms of his chair.

"Are you denying that it happened? It was all in the papers. Way back when. All you have to do is dig. It goes much faster if you're in the computer, of course, which brings us to me."

"You *bastard!*" he whispered hoarsely. "You had no right—"

"No right?" My mouth twisted into a smile. "Let me continue. We'll see who's the bastard. You see, Michael Scarangelli, Collaro's right-hand man, got a little ambitious. Wanted to take over, as a matter of fact. He took out Chernoff, who was loyal to Collaro. Next he had Laws kill me, then killed Laws himself. That was actually a pretty canny move, in a red herring sort of way, because Laws was loyal to him. In reality, Laws had become a liability due to his drug habit, so by disposing of him Scarangelli was killing two birds with one stone. Collaro was in a panic. Was another family moving in? Or had the unthinkable happened—rebellion in the ranks? Collaro was unable to find out, so he turned to you. Really, there was no way to get a definitive answer, but you promised him you'd try. Our regular investigation drew a blank. Then you went and made a mistake. You contacted Scarangelli and had me killed."

Was that a sheen of sweat on his brow? Couldn't be. Not Dantzler.

"Collaro had you where he wanted you, as head of investigations. After so many years in the same position, you felt that you were ready to move on, but Collaro said no. Here was Scarangelli, talking big talk about taking over the whole organization, and making you offers. It was tempting. So you passed word to him to kill me. Oh, and by the way, Sawyer, while you're in there, get some answers for me. That way you look good to Collaro, too. Effectively, you're playing the part of a triple agent in this whole sorry scheme—working for the company, Collaro, and Scarangelli. Since I ended up getting this nice new body, I might have forgiven you, except for one thing. The pain. Vincent Laws enjoyed pain. I couldn't understand why he let me be read into the net. But, you see, he'd been told to. It was necessary to your plan. But Laws wasn't able to resist. It wasn't enough just to get me into the net, he had to make it hurt. For that,

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you will pay."

"But how did you know?"

I ticked off on my fingers. "You asked what I had found out about Collaro. I hadn't even mentioned his name to you yet. Then there was the fact that you'd already had my apartment cleared out. Maybe I had moved and just forgot, but I don't think so. You almost fooled me by starting the clone as soon as my body was killed. Why bother with a clone if it'll never be used? But that was easy—it would have looked distinctly odd to the police if you *hadn't* done so. Besides, it wasn't your money you were spending, so who cared?"

Dantzler shook his head sadly. "It's always the little things, isn't it?" His right hand came up from under the desk holding a gun. I could see fate waiting for me, crouched at the other end of the barrel. A little fast chemistry, and a piece of lead the size of the end of my finger would come boiling out of the end of that steel tube and tear my brand new heart wide open.

"There's just one more thing, Dantzler," I said, and my voice never quavered.

"What's that?"

"You cannot kill me."

The corner of his mouth twitched into a half smile. "And why is that, Mr. Sawyer?"

"Because I have a guardian angel."

"A guardian angel. How droll."

I gestured towards the screen on his desk. "Ask your terminal."

Confusion. "What?" He frowned and glanced at his terminal, then poked his keyboard.

And his terminal spoke to him. In my voice.

"I learned a really cute trick," his terminal said. "I learned to copy myself. Now, the useful thing about copies is that you can rename them, which is how I survived the attempt to kill me here in the computer at work. You destroyed only the copy with the original filename. What you didn't realize is that I watched my death from a safe distance—with a different file name. Now that I'm loose, you can't kill me. Perhaps I should say us. You don't know how many copies there are, or where we are."

He looked up at me, then slowly raised his gun until he had a perfect bead on the center of my forehead. What would happen when he pulled the trigger was something that my imagination refused to consider. Too graphic. Too personal.

The terminal asked conversationally, "Is it worth it, Dantzler? Think about it."

He did, for perhaps a millisecond. Then a slow, malicious smile darkened his face like an evil nightfall. There was something truthful and horrible about that smile, as though his personality was finally oozing to the surface after festering inside for so many years. "Sawyer, you're not—"

The door splintered behind me, crashing to the floor just behind my chair. Had I not been expecting it, I would have jumped straight into the path of the bullet that whistled so close to my head that it cut hair as it passed.

"Freeze! Drop the gun!" A voice used to command. A cop's voice.

Dantzler's face, still not completely thawed from so many years of immobility, had trouble synchronizing with what he was feeling. He held the gun tightly, still canted slightly skywards from when he'd flinched as the door caved in. Barely enough to save my life, but I wasn't in the mood to be picky. Hair grows back, brains don't.

"Drop it!" the cop demanded.

Slowly, realization dawned. His gaze traveled to his terminal. "Your program called the cops, didn't it?"

I nodded. "I've already died once. It's an experience I don't want to repeat any time soon."

He sighed, then carefully placed the gun on the top of his desk.

As the officers handcuffed him, it occurred to me to wonder what the janitor would think, not having to dust Dantzler any more . . . . ■

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Technology can turn any sport into an arms race, but then there are ways to get back to basics . . . .

NANOWEIGHTS

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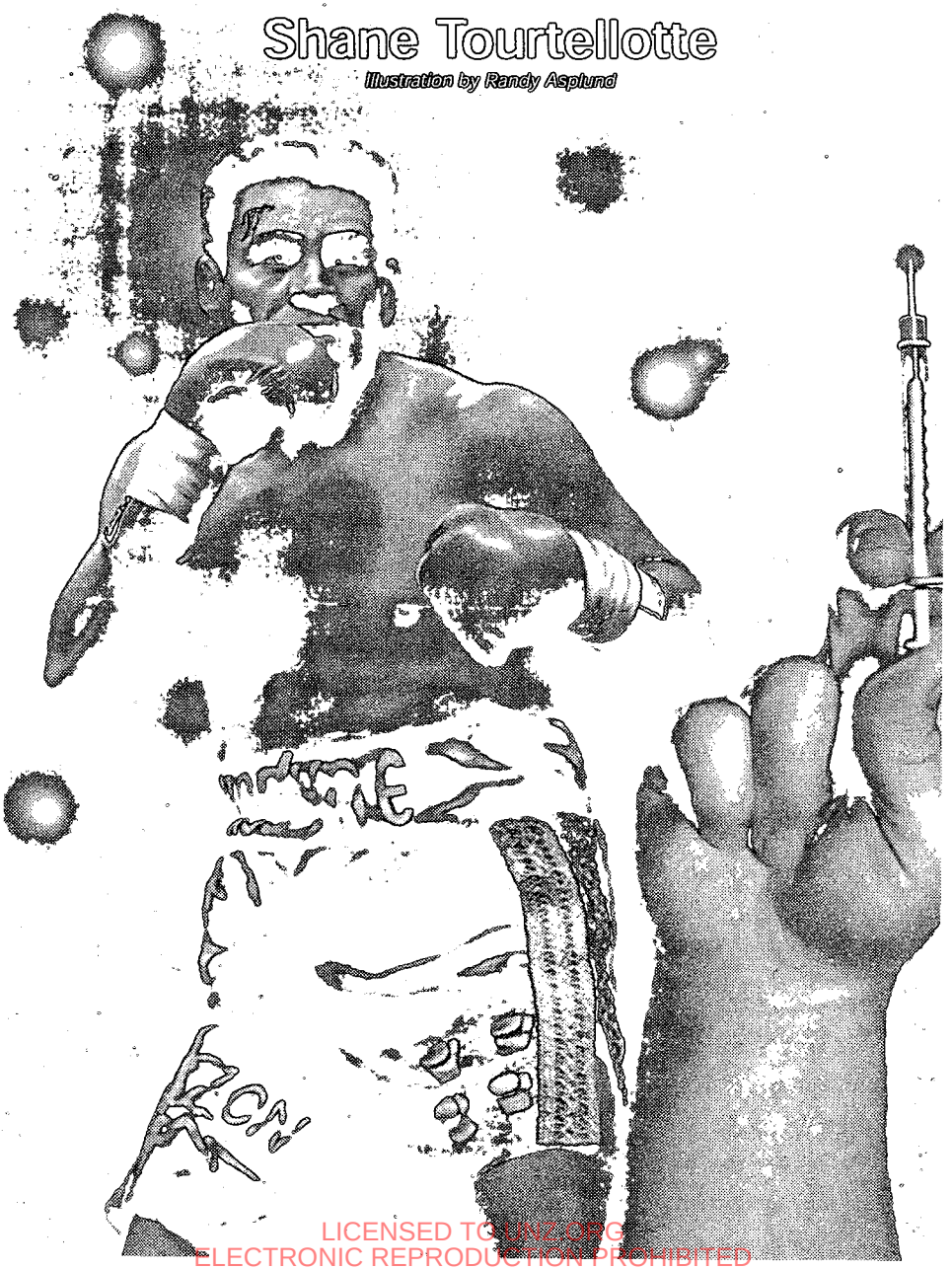

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Luis shadowboxed in a corner of the locker room, waiting for his injections. The WEB Commission inspector was taking his time, as usual. His nerves stayed steady. He trusted Biodyne to know their business, the way they trusted him to know his.

The inspector had dip sensors in all of the vials, checking the concentration of nanomachines. He waved forked fluorescent scanners over the vials one by one, to catch anything in the solutions that didn't register chemically. Evasion had been common in the early years of enhanced boxing, and had almost ruined the sport before the Commission brought strong enforcement.

Leon Gordon watched, his face dark and very serious for his age. Some corner nanotechs might try to go over the four micrograms per kilo limit, then discard the overage if they got caught. He had more pride, and more confidence, than that.

The inspector consulted a palm reader, nodded to the corner team, and walked over to Luis. He got a quick urine sample, and while the dip-rod analyzed it, he ran test swabs over Luis's skin, especially on the fists and inside the mouth. They all stayed white, and the urine checked out.

"Turn around, please," said the inspector.

He produced a pressure hypo, put it at the back of Luis's head just below the cranium, and pushed the injector. Other nanos were custom-made by the sponsor corporations, but these were mandated by WEB rules, and handled by its officials. They would work to break down amyloids, dismantle neurofibrillary tangles, repair neurons sheared apart by the force of an opponent's fists. They were the reason boxing survived in the middle of the century.

He handed Luis his robe, already inspected. "Good luck, Mister Razon."

"Thank you." He didn't offer his hand. He had learned not to long ago.

* * *

He jogged into the arena. It was a decent crowd, nearly two thousand. His was the main preliminary bout of the night, and it sounded like the women who fought before him had gotten the fans into a good mood.

Luis's opponent was there already, bouncing on the balls of his feet. He couldn't see the back of the robe, but the double-helix logos of Designer Nanotech of America wound down both sleeves. They both pretended not to notice each other.

He climbed into the ring, doing his own dance, turning in place. He lingered when the cameras had the best shot of *Biodyne* in stylized script on his back. He knew the routine. It was a trivial price to pay.

The bell sounded, and the ring announcer took center stage. "Ladies and gentlemen, next on tonight's card, fifty minutes of enhanced boxing in the welterweight division. On my right, fighting out of the red corner: He hails from Madison, Wisconsin, with a record of forty-four wins and seven defeats, with sixteen victories by knockout, and weighs in tonight at an even sixty-seven kilograms. He is ranked number fourteen by the World Enhanced Boxing Commission. Ladies and gentlemen, Rick "Stonewall" Hadrian!"

The crowd cheered, while some would-be comedians shouted "Yo, Hadrian!" The bell clanged for quiet.

"And on my left, fighting out of the blue corner—" Some were cheering already. "—from the great city of Los Angeles, California. His record is a perfect thirty-four and oh, with twenty-six knockout wins. Weighing in at sixty-five and one-half kilos, he is the number three contender in the world. Introducing Luis "Rayo" Razon!"

The noise reached a crescendo, and kept up during the referee's instructions. Leon was ready with the hypos when Luis returned to his corner. He worked fast, injecting Luis all over: lactic acid catalyzers in the legs and arms; fibroblast

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stimulators in the jaw, the ribs, and the bare hands.

Eddie Weston, Luis's trainer and manager, kept a keen eye on the other corner. "They're going heavy on his legs, kid," he said, just audible over the murmur of the fans. "They want speed and endurance, so cut off the ring early. Leon, did you give him extra in the left hand?"

Leon nodded, as he pumped swelling retarders into the eyelids.

"Use the left jab. Hadrian can't defend his right." As he spoke, he saw the opposite nanotech applying extra shots on that side. His thick, fleshy hand patted Luis's shoulder. "This guy's all yours." He stepped through the ropes just as the opening bell rang.

The fight was never close. Razon staggered Hadrian early, making his corner use both their ninety-second time-outs before ten minutes had elapsed. Whatever reserve nanos they shot into him didn't help.

Razon wore his opponent down steadily, until he broke his middle finger on a right cross to Hadrian's jaw. He tried to knock him out fast, but finally had to back away and make the crossed-arms gesture for a time-out.

Leon set the bone and injected fresh nanos to further augment the knitting. Razon favored the right hand only for a moment after fighting resumed, and it was a right uppercut that decked Hadrian for the count, nineteen minutes into the bout.

He raised his fists in the air, drinking in the chant of "Rayo, Rayo." The one bruise Hadrian had managed to raise under his ribs was already fading to a dull brown. The fighters embraced as the announcer declared Luis the winner.

One step closer, Luis thought as he returned to the locker room. One fight closer to being champion.

"I was ready for how quick he would be, Gary. I also knew from watching his fight videos that he leans the way he's about to move, so I could anticipate. Once I could keep him in one place, my better hand speed made the difference."

The Sunday morning bullet from Las Vegas to L.A. was half-full, many people returning from watching the last night's fights. Luis hoped he could mingle a little with the fans, but he had interviews scheduled straight until their arrival time. The first-class compartment had two-way video-quality downlinks, letting him talk live with sportscasters.

"Well, it was another great bout," Gary Greenberg said with his trademark enthusiasm. "When are we going to see you fight Haji for the title?"

"I'd take him on today. Maliq has been hidi—" An admonishing hand touched his arm. "Okay, he's had higher-rated fighters to face, but he can't ignore me much longer. Maybe in two months."

Greenberg wound it down, and the camera light went off. "I know, I know," Luis said to Eddie, seated by the window. "You don't want me trash-talking another Biodyne fighter, but I thought you wanted us to apply some pressure."

The shallow lines on Eddie's forehead deepened with a grimace. "You did, by routing Hadrian. You'll be number two at worst in the next rankings. Biodyne won't want to lose a rising star. They'll give us that contract extension on our terms, and that includes a title shot."

Luis nodded slowly. "If you say so, but playing hardball with them still doesn't feel right." An ungainly smile made him look even younger than his twenty-three years. "Talking about myself and other fighters is part of the game. That comes naturally, but I've got no reason to hold Biodyne's feet to the fire. I've been with them my whole career."

"You're talking about sentiment, Luis, but they're acting on business. Give them an opening, and they will exploit you." Luis stayed guarded, so Eddie looked for another opening. "Do you want the championship belt or not?"

"You know better than to ask that."

"Fine. Winning the title takes work,

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and not just in the ring or the gym. I've been in boxing over twenty years. I was in it before there was any nanotechnology: just me against the other guy. I know what hard work means, and I know how easily you can lose everything, even working your hardest. We have to push here. We have to stick together, too. If we do, we can be the cha—" He stopped, abashed. "You know what I mean, kid."

"I do, Mister Weston." An icon began flashing on the screen embedded in the seat ahead of him. A minute later, he was deep into another interview, speaking in rapid-fire Spanish. Eddie blanked it out, watching the mountains speed past his window.

"Mister Razon, good to see you." Michael Brystoc extended a pudgy hand. "Excellent fight you had. I see your finger's good as new. Please, sit down. You too, Mister Weston."

They did, though Eddie looked like he expected the chair to bite him. Brystoc plopped back into his padded seat. Autographed photos and other boxing memorabilia cluttered his desk. The plate identifying him as an assistant manager for sports sponsorship was almost invisible behind a pair of bronzed boxing gloves reputedly once worn by Sugar Ray Leonard.

"Let me say, Mister Razon, I'm very glad you've decided to extend your contract." He opened a drawer.

"Luis hasn't agreed to anything," Eddie said. "We want to see what we're signing first."

"Of—of—of course. It's, er, always uncomfortable when one of our fighters leaves business unattended."

"I've been busy training," said Luis, "and fighting. Besides, my contract has two fights left. I'm not going anywhere yet—" He let the word linger for a second. "—except back to training, so I hope we can finish this today."

Eddie flashed him a thumbs-up, while Brystoc bent over to shuffle more papers. He finally produced a hard-copy contract.

"Here you go, gentlemen," he said, the words flowing off his tongue. "Legal just finished it this morning."

Brystoc didn't have a second copy on hand, so Luis and Eddie had to share. "Twelve fights," Eddie muttered. "Good." He fell silent again, turning pages awkwardly so Luis could still read what he was bypassing. "Don't see anything about a title shot."

"Oh, it's taken care of," said Brystoc.

"Whoa!" Luis took the contract away, scanning one line hard. "'Biology Dynamics, International reserves the right to assign Mister Razon to a new weight division at its discretion.' What gives?"

Brystoc kept himself unruffled. "Yes, that clause is quite an equitable compromise to avoid the, uh, impending awkwardness."

"*What* awkwardness?" Eddie hissed, looking ready to cause some himself.

"Why, Maliq Abu Haji. Mister Blatt and I agreed we should move you up to the junior middleweight division, so your career progress isn't impeded by him."

"He's no impediment," Luis said. "I have to beat the champ to be the champ."

Eddie stood. "Let me handle this, kid. Mike—" He relished Brystoc's discomfiture. "Kicking my fighter up a weight class doesn't do anything for him. It sets him back in the rankings, for one. It also takes him out of his natural weight—"

"One he maintains with the help of our products."

"—and puts him in against bigger men, which is always a harder road."

Luis rose. "I'm not worried about that."

"You see, Weston?" Brystoc smiled at Luis. "Mister Razon is taking just the attitude I knew he would." He produced a gold pen.

Luis shook his head. "No, I'm not. I'll fight anybody, but welterweight's my division, and I want to stay. I want to prove myself against Haji, and I'd think

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you'd want that match."

"What makes you say that?"

"It's obvious. Two undefeated fighters, one the wily champion, the other the hungry young contender. It's a promoter's dream. It could be the fight of the year, for any division. And we're both on your team, so you get all the benefit without risking anything."

Brystoc's mouth puckered, almost disappearing beneath rolls of skin. "You're wrong, young man. Having two experienced fighters with perfect records is a great asset. Why should we throw half of that away, just to keep the belt we already have? I'm sorry, but this office will not approve a fight between you and Mister Haji."

Luis couldn't make himself accept what he was hearing. "If it's a matter of location, I'll go to France, fight him before his home crowd. That doesn't bother me."

"You could fight him on the Moon. It still won't happen."

Luis began to rise, but Eddie stepped into the breach. "We'll consider your offer, Mike. We can take this copy, right?" he said while stuffing it into his pocket.

"Please do consider it. What you perceive now as adversity is really opportunity. I hope you'll come to see that. Good day, gentlemen."

They walked into the labyrinth of office corridors. "Should I wait until tomorrow to flip him off," Eddie said, "or call him at home tonight with the bad news?"

Luis sniffed. "I don't understand people who think that way."

"Good," said Eddie.

Luis had Tuesday off, but that was a relative term. He had an inner-city youth center to visit in the afternoon, and remarks to make to a civic organization at night. Three years ago he never would have imagined himself a public speaker, but he had learned to surpass such limits, at Biodyne's behest.

The appalling toll that dementia pugilistica took on many ex-boxers had nearly driven the sport into extinction, before nanotechnology revived it. With three nanotherapy companies forming the WEB Commission, and others joining later, the sport became a technological showcase for their wares. Boxers' skill and resilience highlighted the quality of those products, the same way auto racers had done for engines and tires a century before.

Enhanced boxing was the most grueling major sport in the world. Its practitioners took enormous punishment, but thanks to their sponsors' nanos, they came through with bodies healed and minds clear. When poor kids or community leaders saw Luis Razon, or any other enhanced boxer, they saw someone whom the worst of defeats could not break, in body or mind. They also saw the way that Biodyne—or DNA or Matsuhashi or ReComCon—could give them some of that indestructibility.

Luis thought it a very fair trade. Too bad other things got in the way sometimes.

"Is Leon here?" Luis asked as he walked out of the locker room. The gym was a small suburban facility shared by six Biodyne boxers, but he was the only one there that early.

"He's working with his bantamweight today," Eddie said. "Besides, you know I don't use nanos the first week after a fight. Is there something wrong?"

"No. No, I just wanted to talk to him."

Eddie studied his fighter. "Something I can help with, kid?"

After a second, Luis flashed a smile. "Don't worry about it. What do I start with today?"

Eddie put him on strength-building exercises, the medicine ball and heavy bag. Reflex exercises had limited utility now, since nanos would change reaction times, but Eddie sprinkled in a few.

"Time!" Luis gave one last swat to the speed bag, and walked over. Eddie suppressed a glare. "You'd better tell me

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what's eating you, kid. Whatever it is, it's wrecking your workout."

Luis shook his head, but his resistance crumbled fast. "Do you think they'll short me in my last fight?" he blurted out.

"What are you talking about?"

"Biodyne. If I play out my contract, without an extension, they may mix inert nanos into my doses so I lose my last bout. I'll end up damaged goods, less of a prize to whoever picks me up—less of a loss to Biodyne."

"No." Eddie gripped the fighter's head in both hands. "Luis, that's stupid. Who's been telling you this?"

"The rumors have been around for years, Eddie. I'm not a complete innocent. Besides, I've heard it from someone I trust, too."

"Who?" Eddie demanded, but Luis would not give up a name. "Listen, rumors are all they are, and stupid ones, too. Any company that got caught doing that would be drummed out of the Commission, humiliated across the world. They'd be risking billions for petty cash."

"But they—I thought you'd—"

"Thought I'd what?"

Luis shrugged. He knew Eddie's sore spot, but thought better of probing it too directly. It needed a more subtle approach.

Eddie took a step back. "All right. Have it your way. I'll break off talks with Cazzaro, and see if I can't get you a fight with Mack Jackson, or maybe Angel Uribe."

"Wait a minute. It's next fight I'm worried about. This fight's fine. I want Cazzaro."

"If you're so anxious over your next fight, you won't be concentrating on this one. I'm just changing things to compensate."

"No." Luis's hands bunched. "Jackson's ranked eighth. Uribe's ninth. I don't want to step backward. I want to face the best fighter I can, and that's Cazzaro."

"His style is dangerous to you."

"I'm dangerous to him! Not just trying to keep me perfect, are you, Mister Weston?"

His face crumpled. "That's their obsession, not mine. They want paragons to parade in front of everyone, completely unblemished. 'Use Biodyne, and be perfect.' It's all advertising hogwash." He stopped pacing. "You want Cazzaro, you've got him. I'll call his manager tonight, and finish the deal. As for you, back to the speed bag."

Luis took to it with gusto, convinced he had won one over his manager. It wasn't long before he realized who had manipulated whom.

Eddie didn't ask why Luis burst out laughing for no reason in the middle of skipping rope.

In the days before enhanced boxing, high-ranking contenders would regularly go three months between fights, and champions would take half a year. Luis was boxing again four weeks after his victory over Rick Hadrian.

It was billed as the battle of the top welterweight contenders, until Chuck Harper scored a decision that edged him past Luis back to number two in the computer rankings. That gave Luis's preparations a sharper edge in his last week of training. Someone had taken something away from him, without even facing him to do it. He was going to get it back, and more.

The four thousand fans at the Bradley Civic Arena in Los Angeles were almost unanimously on Razon's side. They chanted "Rayo! Rayo!" as he entered the ring, and cheered when he doffed his Biodyne robe to reveal the lightning bolts adorning his trunks. They rained boos on Cazzaro when he entered.

Luis could hardly hold himself back during the announcements, the instructions, and Leon's ministerings before the bell. He felt like *rayo*, like lightning: crackling with energy, straining to leap forth and strike the nearest target.

That target was Tony Cazzaro.

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Within four minutes, Cazzaro hit the canvas.

Three minutes later, so did Razon.

He had burned himself out trying to finish Cazzaro early, and not even enhanced metabolism could restore him to full strength immediately. He went on the defensive for a few minutes, using his arm speed to block rather than punch. The crowd's enthusiasm settled on a low plateau, and it wasn't long before Luis wanted them back.

He went back on the attack, but Cazzaro refused to yield the momentum. For a full furious minute, they traded rapid-fire shots, as the fans roared with spiraling fervor.

When Cazzaro's right hand shattered his nose, Luis could hear the tremendous "Oh!" from them, their energy released, the bubble burst. He fought back even harder through the pain, until he heard the bell clanging frantically. He shook his head at Eddie, who still had his arms crossed for time out, but only succeeded in getting more blood to stream from his nose.

Leon was on him the instant he dropped onto the stool. A thin hypo went up one nostril, then the other, shooting coagulant machines into the ruptured vessels. His thin fingers dug into his bag for more ampules. Cartilage knitters, Luis surmised.

"Brace yourself," Leon said, before grabbing the nose and pulling it back straight. Luis opened his mouth for a scream he would not let out.

"You can't stand toe to toe with him," Eddie was saying somewhere. "His power balances your hand speed. You're giving him an even chance."

The next hypo went on the bridge of his nose, its brief pressure still painful. "I'll take an even fight any time," Luis said.

"Would you drop your machismo for one minute? Fight him so you've got the edge. Stay at long range. Lure him. Make him come to you, and be ready when he does."

Eddie's assistant sponged the blood off Luis's face and chest, while Leon finished his battery of shots with one right up the nose again. Pain receptor blockers, Luis thought, as the throbbing subsided. As long as he could think straight enough to keep up with his nanotechnician, he assumed he was in good shape.

He remembered Eddie's advice, dancing at the far edge of his range, popping Cazzaro with jabs. They would get him points on the computer judge, but not go as far with the two human arbiters. They also wouldn't do much damage to Cazzaro, but they would get him frustrated, if he didn't keep his head.

He didn't. He moved in, swinging away at Razon's nose, trying to exploit the weakness in the little time that it remained weak. Luis dodged for a while, but eventually one blow caught him there squarely. He reeled away.

Cazzaro moved in for the kill, hands lowered, and charged straight into a left hook that threw him against the ropes. Razon was on him immediately, his faked reaction forgotten. He pummeled Cazzaro until the man got him in a clinch so he could call time.

Luis was never in trouble after that. He controlled the pace, kept Cazzaro moving, got close only when his opponent let his guard down. Cazzaro tried taunts and showboating, and left openings too good not to exploit. Luis never took the bait.

Cazzaro called time thirty-one minutes into the fight. "It's those Matsuhashi nanos," Leon said in the corner. "They're weak at processing lactic acid. His legs are cramping."

"You've got him, Luis," said Eddie. "Keep your distance, and the decision's yours."

"Yeah," Luis replied, "but I want the KO. It'll send a message upstairs."

"You don't need the knockout to win."

"No—but *be* does. He'll come in, and I'll be waiting."

He was right. It turned into a bullfight,

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with Cazzaro making increasingly weary charges, and Razon maneuvering away and counterpunching. When the moment of truth finally came, his flurry of punches was too fast for most eyes to follow. Cazzaro nearly beat the count on his knockdown, but his grip on the middle rope slipped.

The crowd was soon hoarse with yelling, but rallied to start a fresh chant: *"¡Dános Haji! ¡Dános Haji! ¡Dános Haji!"* They wanted the champion next. Luis could only wonder if he would be able to deliver.

"Thirteen reporters have interviewed me in the last two days. They all asked when I would get a title shot. I couldn't tell them anything."

A smile dimpled Brystoc's face. "Your restraint is laudable. It keeps rancor out of the business relationship." He handed over a pair of palmpads. "I believe you'll find it rewarded."

Luis and Eddie each took one, and scrolled them down as fast as their eyes could follow. "Five fights?" Eddie muttered, a second before Luis caught the bigger change.

"You're fighting me as a *junior* welterweight now?"

Brystoc's smile brightened. "Van lost the title last week, and confidentially, he may be retiring. We want that belt back, and we want you to get it." A fleshy finger pointed to Luis's pad. "You'll see you're guaranteed a title shot by your third fight on that contract, provided you continue to win against ranked opponents."

Eddie nudged Luis. "You're also locked into automatic contract extensions as long as you stay champion."

"At substantially higher guaranteed purses," Brystoc countered. "That is standard contract language, Mister Razon. Your manager will confirm that."

Eddie gave a nod. "He's right about that. The contract terms aren't bad."

"I believe we have acted in good faith to meet your demands. You wanted a title fight, and you'll have it. You didn't want to move up in weight classification, so we are moving you down instead."

"You don't understand." Luis was calm, measured, but firm. "I didn't want to move at all. I want to succeed where I am. Moving me down a division—that's worse than before. It looks like I'm running away, like I can't pick on someone my own size." He slapped the pad onto the desk, clipping a framed photo. "No deal."

Brystoc raised his eyes with a well-cultivated air of long-suffering. "What exactly do you want, Mister Razon? No, I can anticipate your answer: a title fight against Maliq Abu Haji. What *else* is there that would satisfy you?"

Luis's mouth lifted. "I'd gladly fight whoever's welterweight champion, Haji or not." The implication that Haji wasn't immortal set Brystoc to scowling. "Aside from that, nothing. I've had thirty-six fights, and won them all. I've earned this chance. If you won't recognize that, maybe I'll appeal to higher authority."

"I am the highest authority."

"Does John Harker Blatt know you're saying that?" Eddie piped up. "Most people's bosses wouldn't take that talk well."

"The executive manager and I consulted on this contract. He shares my opinions. This is as far as we go, gentlemen."

Luis traded looks with Eddie. "Then we shouldn't waste more of your time," he said, getting up. Eddie followed right behind.

A glance back showed Brystoc's face turning down dourly, before he began tapping at his computer. They left him that way.

There was nothing left to do, except train, fight, win, and field offers. Eddie looked forward to the bidding war an undefeated, number-one-ranked free agent would spark. Luis cared most about one bargaining criterion—but the negotiators didn't have to know that.

Eddie rattled his head, shaking himself

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out of a daydream of big numbers. He was watching Luis at the target mat, a large, soft pad hanging on the wall and flashing lights. It measured response time, accuracy, and power, and so far Luis was matching his usual standard.

"Time," said Eddie, just as the mat's own signal went off. "Pretty good, kid." Luis nodded, even as he toweled his face dry. "Five minutes of moving targets next. Ready? Hey, kid, I'm over here."

"Leon," Luis said, looking over Eddie's shoulder. "I didn't think you were due in today. Paying a social call?"

Leon trudged over, his face pinched. "Guys, I—" He swallowed. "I've been reassigned."

"What!" came out in unison.

"To Ben Eunoto's camp, effective tomorrow."

"Geez, super-heavyweights," Eddie said. "They always need more of everything."

"Who's replacing you?" asked Luis, looking strained.

"Some guy named Posey. I don't know him professionally." He looked at Luis and grimaced. "It's happening just the way it did last time."

"What is?"

Leon faced Eddie. "A fighter getting a new nanotech for the last fight of his contract. I got replaced this way on Robby Weller's team two years ago, just before his first loss."

Eddie's eyes narrowed. "You told him about that. Why did—" He stopped, as it soaked in further. "Why haven't you gone to the Commission, or the police? Can you prove this?"

"Of course I can't prove it. The corporate managers didn't tell me their reasons, and do you think the replacement nanotechnicians would admit it? If I went to the Commission, how long do you think I'd keep my job?" He held out his hands. "I have a family to support. I can't stick my neck out. I'm sorry."

Eddie frowned. "No, this is coincidence. I don't believe it."

"Why not?" Luis said. "I'd think you'd be the first to believe they could—"

Luis stopped, but there was already a twinge of pain on Eddie's face. "I would, if I thought it was in their interest. Problem is, this hurts them, too. A loss goes on their record, not just yours."

"They can afford a few extra losses here and there," said Leon. "They're looking at a bigger picture.

Eddie still shook his head. "It doesn't add up," he said, almost pleading.

Luis stepped in. "Well, we don't have to let it happen. Eddie, talk to Biodyne. Tell them we want to keep Leon in our corner. Ask them too, Leon. It's only one more fight. If they agree, our worries are over."

"And what if they refuse?" asked Leon.

"Then it's Plan B. Eddie, hold off on negotiations for a while. Don't finalize any deals until a week from Saturday."

"What's Saturday?"

"The Haji-Harper fight," Eddie told Leon. "I was going to do that anyway, just in case."

Luis smiled. "If Haji loses the belt, Leon, Biodyne will need somebody to win it back, preferably someone unbeaten for their image. They'll have to turn to me."

"You think Haji's going to lose?"

"No, but it's a chance." Luis looked at the floor. "And the wait will give me time to think of something else."

Luis had more than enough time to think.

He couldn't be sure Leon was on the money. It might be paranoia, or a weird guilt complex from his fighter losing only after he left. The facts checked out, those few Leon had. But there were always more facts.

He downloaded a decade's worth of fight and contract statistics into his home computer, and had the spreadsheet program crunch them to fine powder. In a few days, he had answers to questions he had never imagined—but not the one he wanted.

Average fighters did no worse in the fi-

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nal fight of a contract than in any other fight. Ranked fighters did somewhat worse, but once he filtered out the effect of rising into tougher competition, it was on the edge of normal statistical variation. Breaking the stats down by corporation illuminated nothing regarding Biodyne, though one or two competitors might stand some Commission scrutiny.

Luis gave up, his time wasted, and a definitive answer elusive. Biodyne had already refused to let Leon stay on. Now he could only wait for the Haji fight, and try to drown his worries in training sweat.

"Are you listening, kid?"

Eddie's voice came over the speakers, masking the sounds of the heavyweight undercard Luis was watching. They had both bought the boxing program, so they could watch the Haji-Harper fight and scout the boxers together.

Luis didn't answer. He was throwing punches at the air, arms pumping as fast as he could make them, breath coming in ragged draws. His eyes never left the screen.

"Luis, what's going on? Luis!" Luis finally stopped, forehead dripping, arms aching. "Is something wrong?"

"No. I—I was testing my hand speed against these fighters."

"You what?"

"I was trying to punch as fast as they do during the flurries—like that one. I couldn't manage it. Fighters who outweigh me by forty kilos, who have punched themselves out for most of an hour, are still moving faster than I can."

"Luis, they're enhanced. We're not starting you on training nanos until we choose an opponent. There's no way you can match them."

A sigh. "I know. I had it in my head that, even if my nanos were impaired, I could still get by on training, experience, smarts. I was wrong. I'm not good enough, not by myself."

"Kid, I told you to put it out of your head. You'll only end up beating yourself."

"Eddie, I can't turn my brain off. I'm not a machine." He laughed harshly. "I only use the machines . . . or the other way around."

"Turn off the fight."

Luis blinked. "What do you mean?"

"Turn it off, and look at me." Eddie was waiting to fill the screen when Luis minimized the fight window. "I was a good boxer fifteen years ago. Very good. If enhanced boxing hadn't come along—have I ever told you why the corporations wouldn't sign me?"

"I know," Luis said. It wasn't Ed Weston's fault the WEB Commission had banned him from enhanced boxing. It was the fault of his apoE gene, allele epsilon-4. It rendered him highly susceptible to lasting brain damage, the wellspring of bad publicity the nanofacturers didn't dare risk tapping. His career had suffocated fifteen years ago, in his physical prime. Retrenching as a trainer and manager was his only way to stay in the game.

"Well, if I had kept boxing, I would have fought for a middleweight belt someday. Go look it up."

"I did," Luis said, "years ago."

"I'm proud of my career, Luis. I'm not too proud, though, to say that you probably would have beaten me in my prime without a nano in your body, and that's with you fighting two classes below me. If you didn't have the natural ability, nothing Biodyne gave you would have brought you to where you are."

"I understand what you're saying—and I'm honored—but it cuts both ways. The nanos aren't enough, but neither am I by myself."

Eddie groaned. "Listen, maybe I can get the Commission inspectors to do special tests before the fight, verify that your nanos are all active."

"They don't like interference, in any direction."

"Well, I don't know what more I can do. I still think you're worried over nothing, but if you're determined to psych

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yourself out, I can't stop you. Hey, they're getting into the ring. Time we got to business."

They watched the fight as they always did, Eddie and Luis pointing out the fighters' strengths and weaknesses to each other, trading ideas for strategies. What was different was Luis, for the first time he could remember, silently hoping for Maliq Abu Haji to lose.

Biodyne fighters were teammates, and you didn't root against a teammate. He did this time, though, to no avail. Haji dictated the fight's pace, got through Harper's defenses with his trademark pinpoint accuracy, and cruised to a unanimous decision.

He listened to Eddie's post-mortem, his theory about how Haji telegraphed his right jabs, his criticism of Harper's weak defense of his ribs. Some of it sunk in, but that subsurface dread kept picking away.

"You can beat Harper," Eddie declared, and Luis agreed. All else being equal, he could, but other people might combine to take away that chance.

A fair fight. That's all he wanted.

And maybe he could get it after all.

"I've got an idea," he said, not noticing what analysis he had interrupted. "Eddie, we can look up personnel data involving other corporations' fighters, can't we?"

"Sure. They make that public. Looking for an edge on some fighter?"

"No," Luis said, smiling for the first time that night. "Just the opposite."

Angel Uribe was in the ring, waiting for him. The Vegas fans either loved Uribe's flashiness, the gold accents in his hair, the Mercury wings on his boots, or hated it. Razon didn't get as many cheers, or as many boos.

It had been an intense two weeks of training. Uribe's camp had insisted on an early date, having last fought a fortnight before Razon. That didn't worry Luis. He was always in shape, and Eddie barely needed two days to break down Uribe's technical flaws.

Luis climbed through the ropes and danced in place, looking at Uribe's face. Nothing penetrated the mask of impassive ferocity. Not even during their staredown during the referee's instructions did Luis see a glint of agitation over the long locker room inspection, or of suspicion that Luis himself had made it necessary.

Eddie had known Uribe's handlers would gladly fight the top-ranked contender, even with their number-nine man in the last fight of his contract, just like Razon. He had also known that a couple confidential words in the ears of reporters who owed him favors from way back would be enough to incite a wave of speculation.

They knew the rumors. They suspected both companies might give their fighters bad nanos. They knew this might just be the first unenhanced fight in fifteen years, an idea with gruesome fascination for many fans.

Luis had known the companies wouldn't stand for such speculation. Biodyne and ReComCon both asked for special oversight from the WEB Commission. They had gotten it. The pre-fight tests took five times longer than usual, even as the officials blandly denied anything was out of the ordinary.

It was a perfect solution. Uribe got a shot at the top contender. Eddie got his fighter's head screwed back on straight. The press got a juicy story. The commission looked good ensuring that this was an enhanced fight. Biodyne got some bad publicity—payback for their contract ploys—but they also got heightened interest for their bout, which meant more paying viewers.

And Luis got what he had wanted when he set everything in motion. He got a fair fight, an even chance. That was what the sport, any sport, was about.

The bell rang. Luis grinned as he strode forward to throw his first punch, to take his chance. ■

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TWO EDUCATIONAL WEB SITES WIN $1,000 IN THE FIRST ANNUAL "WEBS OF WONDER" CONTEST

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Webs of Wonder

A Contest to Foster Internet Sites That Combine Teaching With Good Science Fiction

Sponsored by *Analog* Magazine and David Brin

This year's *WOW Contest* - for educational web sites that use *science fiction* to help classroom educators teach difficult subjects - has been won by James Van Pelt of Colorado and Andrew E. Love of Maryland, who will share the *$1,000 prize* at a ceremony in Chicago, at the World Science Fiction Convention, on September 2, 2000.

Jointly sponsored by Analog Magazine and David Brin (best-selling author of *Earth* and *The Postman*), the Webs of Wonder Contest aims to generate new resources for educators, using distinguished science fiction stories, novels and films to complement regular curriculum materials, helping teachers spark enthusiasm and convey difficult subjects in the classroom.

For years, individual educators have given students science fiction tales to help enliven difficult topics. A chemistry teacher might illustrate part of her curriculum with a classic Hal Clement novel. An ethics class might argue deep questions raised by Tom Godwin's famous quandary story "The Cold Equations." A good fictional portrayal can make that crucial difference, helping a confused student say *"Aha, now I get it!"*

Alas, these efforts have mostly been isolated. Great teachers had no easy way to share their study guides, illustrations, provocative question sets . . . or the story itself. Until recently, that is. Today's Internet empowers teachers and web-designers to develop vivid materials that brighten any subject, then share with colleagues around the world.

Moreover, this approach can also help get compelling literature into the hands of young people who might otherwise never come across some of today's greatest stories.

The winners of the year-2000 WOW contest. James Van Pelt, a high school teacher in Colorado who also writes science fiction, created a web site offering a High School language arts curriculum set based on H.G. Wells's ground breaking novel *The Time Machine.* In a more eclectic approach, Andrew E. Love offered study-and-question guides for several recent science fiction stories that illustrate issues of science in the classroom.

These finalists, and other entries submitted during 1999-2000, can be viewed at *http://www.analogsf.com/wow*, where revised rules for next year's contest can also be found. The 2000-2001 round will emphasize sites that use stories and novels to help teach *high school science curricula*. Contestants are encouraged to form teams that focus on a currently-used school course, text or syllabus. Best results may be achieved by combining real classroom experience with proficiency at web design and a love of good, exciting stories.

The second contest will have an entry cutoff date of July 15, 2001.

For details about rules, available supporting materials and how to enter, see our web site at *http://www.analogsf.com/wow* or *http://www.davidbrin.com/*

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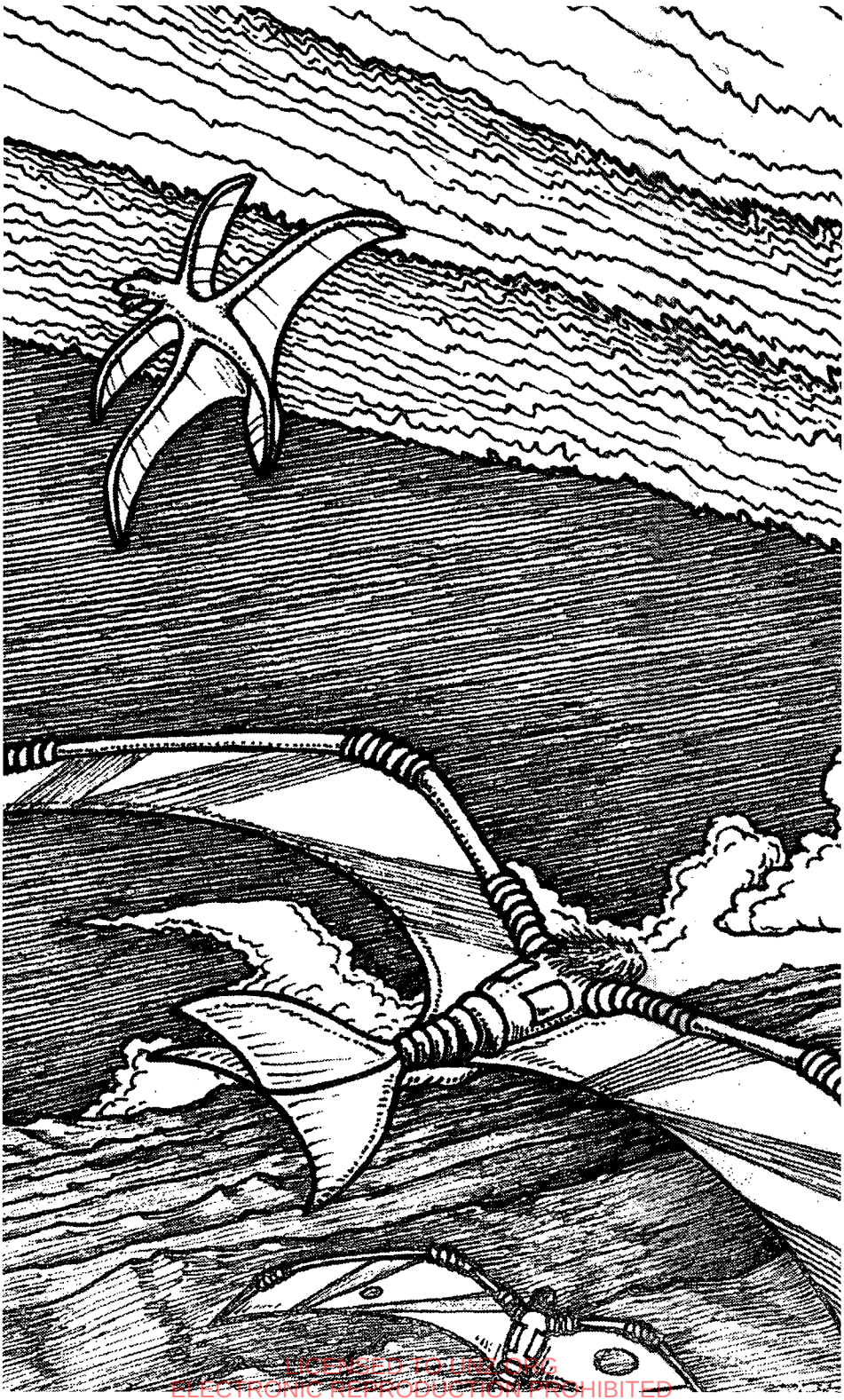

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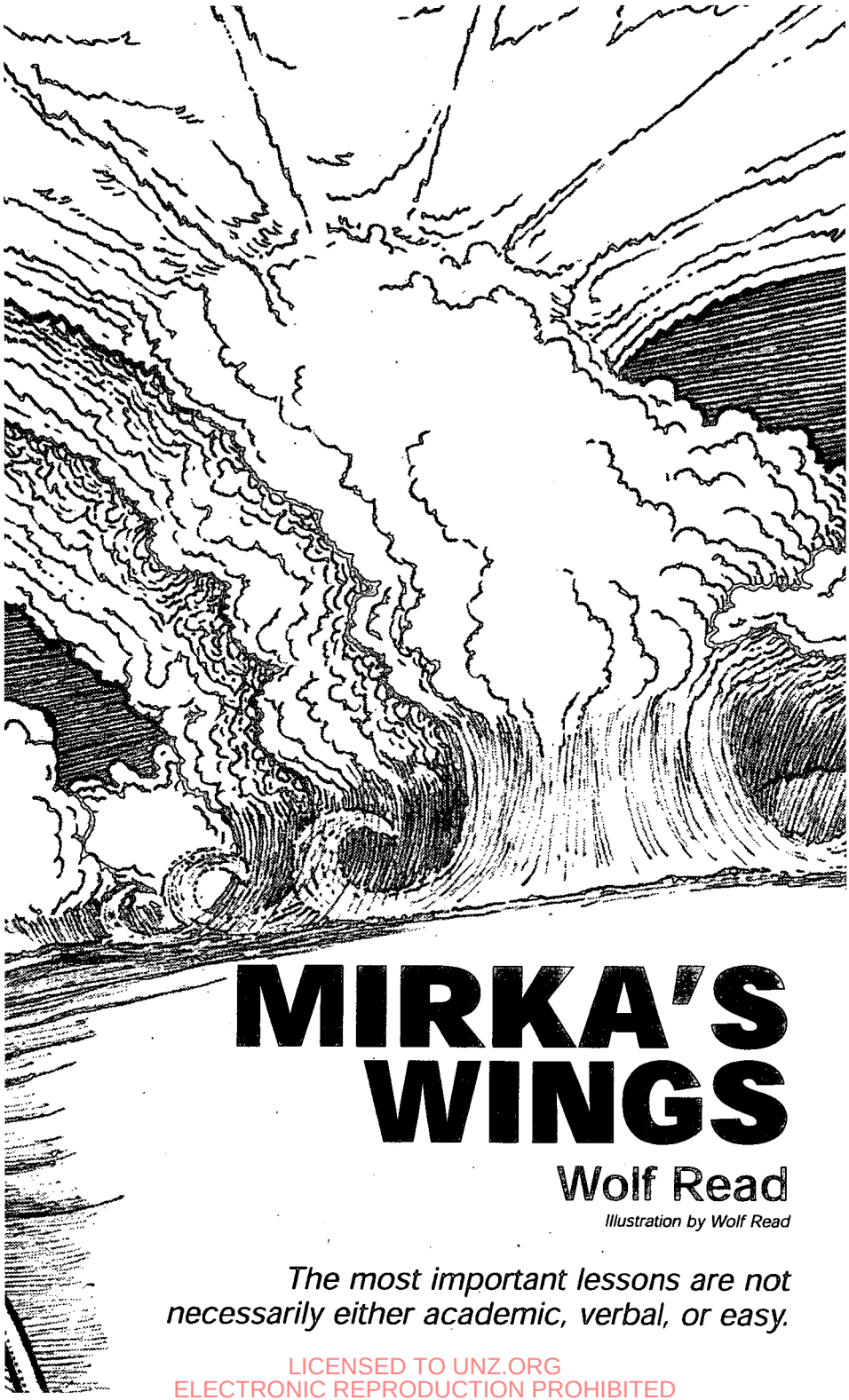

MIRKA'S WINGS

Wolf Read

Illustration by Wolf Read

The most important lessons are not necessarily either academic, verbal, or easy.

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There comes a time in each life like a point of fulcrum. At that time you must accept yourself. It is not any more what you will become. It is what you are and always will be.

—John Fowles

Mirka walked to a delicately sculpted rail that marked the rooftop's edge. She peered over the side, at densely grown pagoda trees. Each tree aimed its mushroom-like leaf at the tropical Taranis as perfectly as a vast human-built solar array. The harsh Taranislight warmed her back, but not too much. The thermoregulating abilities of her jumpsuit, one that had been made to fit her smaller-than-average—for a twelve-year-old—size by the replicators, kept her at a comfortable temperature.

A dark shadow passed overhead. She heard a series of melodic whistles. "Surprise!" her implanted translator reported, though she could have deciphered the simple phrase with her limited ability at utherspeak.

Her Eponan friend darted away, its long, narrow forewings arcing casually in a leisurely, yet momentum-building, flap. The uther's wide, triangular hind fluke bowed upward as it gave the creature lift. Eaccae's flanged tail trailed smoothly behind its ovoid, earth-toned body, subtle colors that matched the pagoda foliage below. The uther's motions were more fluid than any human she'd seen—all due to the tentaclelike flexibility of the osmotic myoskeleton common to Epona's avians and pagodas.

"Eaccae!" Mirka called excitedly. She stepped off the edge.

Wind whistled around her with the howl of a hurricane, whipped her long hair, and rippled across her jumpsuit. Her stomach seemed to fall away—lovely!—and she could hardly stifle a scream.

Straight below, the pagodas' circular leaves widened like frightened eyes as she neared them. Weyr's towers weren't high enough! She extended her arms, and spread eight-meter wings into the rushing air.

The muscle-augmented wing's superstrong, flexible composite gripped atmosphere, and her lightly covered toes skidded softly across the topmost leaves of the lush forest. Using her momentum, she turned upward and gained altitude quickly.

"Foolish games!" called Eaccae, the notes sounding pretty in her ears. Eaccae banked, dropped low, and smoothly sailed several meters above the tall spires of two cathedraltree pagodas. The uther's motions were delicate and beautiful.

I can do better! she thought. She aimed herself directly at her friend—air tag with an uther was difficult at best. Eaccae rolled, then dropped away. Such perfect flight execution! Mirka held her wings back and dived, attempting to catch elusive Eaccae.

"You mean fun!" Eaccae may not have heard her reply, she realized, for the uther had pulled out of its descent and now soared in a broad circle far above.

She turned upward, and flapped hard. Taranislight reflected like diamonds from small ocean waves a kilometer to the east. In the hazy distance, snow-capped volcanic peaks enclosed the Sere Valley on three sides. Spotty cumulus sat above the western ridges. The glittering colony building, a series of hemispheres full of large windows and surrounded by broad, sweeping balconies, shrank below her. In the distance, hazed by the moist atmosphere, she could see the mushroom-shaped towers of the Tiene Eilean Laboratory for Eponan Study standing above a low, jungle-covered ridge. Mom and Dad were working at TELES today, studying Epona's ceretridons.

Mirka reached Eaccae's height, matched its deliberate slothlike pace, and drifted eastward. She frowned. "You let me catch you."

"More careful you should be," Eaccae

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sang. "Not safe diving close to the ground."

She said nothing, and wished that her fall had impressed Eaccae.

Below Mirka, a large uther slowly flapped northward, hanging just a few meters above the pagodatops. The uther's triwinged shadow distorted in myriad ways as it bounced up and down the curved pagoda leaves. The uther carried a shiny object near its head.

"That big uther's flying low," she said. "Why can't I?"

Eaccae turned its head and glanced downward with a sideways-facing eye. "Adea's role is to fly low."

Wow, a job where extreme flying is accepted! "Who's Adea?"

"Adea is one of the most respected of my flock's hunter wing."

The Deebee-ace flock, Mirka knew from her schooling. The flock allowed Weyr colony in their territory for gifts of human technology. Over time, the flock had started helping people learn about Epona. The union had lasted for so many years—over a hundred!—that the two cultures sometimes seemed like one. Uthers freely moved about Weyr, and she could visit uther roosts any time she wanted, though legal boundaries still existed for the safety of humans. She wasn't supposed to go beyond the treaty bounds, but she had on several occasions. The uthers didn't mind.

Growing curious, she asked, "What does Adea do?"

"Adea is a Croc-popper."

Mirka laughed at the title, even though she had heard it before.

"Why humans find humor in the position," replied Eaccae in low notes denoting seriousness, "long mystery it has been to me."

"I'm sorry. You should hear the translation!" Embarrassed, she tried to make it up with another question, "So, croc-poppers are hunters, right?"

"Ceretridon hunters they aid. Any springcroc that threatens will be dispatched."

"Is Adea looking for a *springcroc?*"

Eaccae glanced at Adea. "Yes. Weapon carried only when on a hunt."

"Let's follow, and see if Adea'll find a springcroc!"

"We should not. Independent croc-poppers are. Anger Adea, you would."

"Maybe not." She dropped away from Eaccae.

Eaccae hesitated before diving behind her. "Stay far-far-far! Strong powers of observation, croc-poppers have!"

"I'll stay far—at least until Adea finds a springcroc."

"Croc-popping not interesting to see," Eaccae said as it pulled up alongside her. "Mirka, seek trouble always you do, why?"

"You mean fun!" Keeping a comfortable distance from Adea, she dropped below the highest pagodatops. Eaccae followed, floating to the right.

The motors in her wings provided a lot of power. Still, she had to pump her wings hard to keep up with Adea, a rude reminder of the disadvantage she had because she was stuck with a human body. An uther could easily outspeed her in straight-line flight, a fact that was especially noticeable when they used their adrenal-like "boost" chemical for extra endurance.

"Hey! Where'd Adea go?" she exclaimed through ragged exhalations. She glanced around, trying to spot the uther's distance-reduced form.

"Trees near-far-far Adea just flew into, I think. Dangerous springcroc it may have—"

With all the presence of a starship, Adea's large triwinged form erupted through the foliage. Adea's long tail nearly struck Mirka's face as she dodged its three-meter-wide hind fluke.

Frightened, she flew upward, and quickly realized that hiding in the trees would probably have been smarter. Eaccae rushed past her, bolting quickly into the indigo sky.

"You two!" said Adea, its melodic

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voice loud and sharp. "Stop! Eaccae?"

Eaccae slowed. Banking hard, it dropped past Mirka.

Groaning, she turned and followed her friend.

"On those pagodas!" Using one of its three-fingered mouthpart limbs, Adea pointed to a stand of cathedraltrees.

Mirka, looking sheepish, glided to the nearest pagoda top. She landed in the center of its giant leaf, grabbing a bulbous growth bud for balance. Her disturbance sent the tree into a gentle sway. Eaccae dropped onto the pagoda next to hers.

Touching down on a taller tree, Adea faced them. Adea's neonate, suckling a nipple on Adea's back, watched Mirka with shiny oversized eyes. Mirka nervously looked down at her feet, understanding that the neonate marked Adea as a full uther adult, due much respect.

"Eaccae," said Adea, "Surprise me, you. Interested in hunting, you have not been before."

"I *am* not. I—"

"Not? Disturb me why, if not to learn?"

Eaccae glanced at Mirka.

"The human?" Adea studied her with one eye. "The foolish one, is she not?"

"Foolish?" exclaimed Mirka, feeling hurt by the remark.

"Stunts you do that no sane uther would try, save out of necessity." Adea chuckled, a deep barking that sent its whole body aquiver. "Now, follow me why?"

Fuming, Mirka debated answering the question.

Adea stared at her.

Growing uncomfortable, she said, "I wanted to see a croc-pop."

Adea pondered her answer for a moment. "Neonate's game, croc-popping is not, though think so humans may."

"What do you do, bash the big clam shell to pieces with that hammer?"

Adea lifted the tool, studying its large blocky top, engraved forearm-long shaft and beveled end. "Grown you pretend to be, neonate. Hammer it is not. Croc-popper it is." Adea looked at her. "Want to see a croc-pop, why?"

"I haven't seen one before."

"To learn? A noble cause, neonate."

Mirka smiled, feeling good about pleasing the uther, though not exactly sure how she had done so.

"Croc-popping, you are not ready to see."

Frowning, she said, "Why?"

"Three levels of training, a croc-popper must do. Level zero, you are."

"I can do level one! Surely!"

Eaccae suddenly looked at her, like it had been surprised.

Adea pulled a leathery bag from its neck belt. Shoving the extensile muscles in its arm straight forward, as opposed to the swinging toss Mirka would have used, Adea threw the bulging container to her.

She caught the sack with both hands, the motion causing her pagoda to sway. "What's in here?"

"Food to help neonate croc-poppers learn."

She opened the bag and looked inside. Long stringy pieces of flesh, like jerky, sat on the bottom. The food smelled good. Realizing that the flesh had to be Eponan, and could be poisonous to her, she asked, "What kind of meat is this?"

"To gain Caafgea's past skills, eat its flesh must one, to bring Caafgea's knowledge to the present, making it available to learn."

"So Caafgea's a springcroc?"

"Half-sibling is Caafgea. On a croc-popping hunt such as this, died Caafgea several days ago."

She gagged. "You mean this, this . . . is an uther?"

"Neonate, yes."

"Yuck!" Feeling sick to her stomach, she tossed the bag into the jungle and flew away, flapping as hard as her small arms would allow.

Adea laughed loudly behind her. "Neonate, ready you should be before

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you follow our hunts!" Adea bellowed harder, fully enjoying its prank.

She heard Eaccae flapping right behind her. "Listen to my warnings, will you?"

"That's sick. Having me eat an uther!"

"Ancient tradition is eating the dead to gain knowledge."

"I still think Adea's disgusting."

"Uther flesh, that food was not. Tricked you, did Adea. Real uther flesh Adea would not use for a prank. Befit the dead, such would not."

"Eaccae," called Adea, "speak to you I must!"

Eaccae lowered its head and turned around.

Eaccae's words made Mirka feel better, but she still had an uneasy feeling in her gut. Why did Adea retrieve the bag so suddenly after it stopped laughing?

After being away far longer than Mirka expected, Eaccae finally caught up to her as she neared Weyr.

"Look! It's some of my classmates!" said Mirka. She banked toward Weyr's highest balcony.

Mirka landed next to Cassie, her closest friend. Mark, another friend, tested his dark blue wings nearby.

"Where've you been, Mirka?" called Cassie. Her brown eyes glittered cheerfully under the bright Taranis. With thin-fingered hands, she bundled her long blonde hair into a pony tail.

"We saw a croc-popper!" said Mirka.

"A what?" Cassie asked casually, while stretching out her pretty lavender wings.

Eaccae landed next to Mirka, lifting its body up on the two long front wings, while using the rear fluke as a third point, making a tripod stance. "A croc-popper. Adea, a warrior most respected."

"They hunt springcrocs," added Mirka.

"You shouldn't go near springcrocs!" admonished Cassie.

"Yeah," said Mark. "Remember what happened to Aaron?" He flexed his sturdy arms and slapped his wings together, in obvious imitation of a snapping springcroc. His broad, freckled face looked serious.

Mirka nodded, remembering that Aaron had been ambushed by an unusually large springcroc, one that was strong enough to crush her to death with its primitive clamlike jaws. That was a grim time for all at WEYR.

"That was a long time ago," said Mirka. "And security got rid of it. Let's play."

"How about a game of air tag?" said Mark as he walked next to Cassie. His broad build made him look larger than her, even though she had a several centimeter advantage in height.

"Boring," said Mirka.

"Waterbombing?" said Cassie, with a hopeful tone.

Mirka shook her head. Though it was fun for a little while, she saw no challenge in dropping water balloons from the air.

"What, then?" asked Mark, looking anticipatory.

"The 'Game of Dares,' of course."

Mark groaned. "Not GoD!"

Cassie frowned. Eaccae looked at Mirka curiously with one of its eyes.

"And what's wrong with my game?"

"You're kidding, right?" Mark chuckled sarcastically.

She gave him an ugly look.

"Remember what happened last time? Aerial cartwheels. I hit the ground face first!"

"I can't help it if my dares are challenging."

"More like reckless."

Feeling disappointed, Mirka said, "What if I keep the dares easy?"

Mark looked at Eaccae. Cassie idylly scanned the sky.

"How about," said Mark, "having Eaccae choose the dares."

Insulted by the question, Mirka said sharply, "You don't trust me?"

Mark looked her in the eye. "Frankly—"

"Hmph! I guess I'll fly by myself." She

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turned and angrily stomped towards the roof's edge.

"Wait!" called Eaccae, with its melodic chirping voice.

Looking back, she said, "What?"

"Compromise," Eaccae whistled. "Choose the first dare I will, then we alternate. One dare each of us gets to choose. Loses chance to choose, those who refuse the given dare. Choice then moves to the next in rotation."

Eaccae's going to play GoD! He had never done so before. Happy with the arrangement, Mirka walked back to the group and said, "What does the winner get?"

"After a single rotation, choose the next game, the one who completes the most dares. Play the new game losers have to, even if they find it boring."

Certain that she was going to win, she said, "Great! Let's hear the first dare."

Eaccae waddled to the edge of the landing platform and scanned the endless jungle with a single eye.

Mirka noticed that Mark seemed to suppress a smile, and Cassie seemed unusually quiet. "Mark, what's so—"

Eaccae broke in, "Those cathedraltrees." With its strangely flexible arm and hand, Eaccae pointed to a large stand of the titanic pagodas. They stood above the rest of the jungle like a cluster of high rises in an ancient city core; stately, bold, and imposing. "Fly through their hollow bases, we must."

Easy. Mirka smiled and nodded.

"But," said Cassie, looking worried, "there could be springcrocs!"

Eaccae looked at her. "Keep springcrocs away from Weyr Adea has been, ever since the attack on Aaron. Patrolling right now Adea is, as mentioned. Safe we will be, if stay close to Weyr we do."

Cassie nodded. She looked at her wristcom.

Mirka lifted her wrist and checked her own wristcom. *Yep, its operating*.

She glanced at Eaccea and didn't see one on the uther. She wasn't surprised. Uthers preferred to carry little. Some didn't even wear translators. And a very few shunned all human technology, fearing—rightly—that the devices could be used to spy on them.

Eaccae launched from the balcony. Its wingbeats were powerful, threatening to shove Mirka backwards. She ran off the roof and lifted into the air behind Eaccae. She heard Mark and Cassie's flapping as they followed close behind. After a several hundred meter gain, Eaccae circled above and waited for them to catch up. Mirka flapped harder, wishing she could climb as fast. Eventually she reached the uther's altitude, panting hard from her efforts.

Eaccae darted below her. In seconds, the uther had a lead she could never catch. She felt a pang of envy. *If I were just an uther!* She dove and followed Eaccae, flapping as fast as she could.

Not to be outdone, Mark closed in on Mirka, pushing the air with fast beats and clenching his teeth like a boy possessed. She was not going to be beaten by a *mere* human—and she decreased her angle of attack, diving toward the short pagodas just ahead of the cluster of cathedraltrees.

Eaccae turned sideways and slipped through a gap between two pagodas. Without slowing, it passed through the base of the first cathedraltree, fading into the jungle darkness.

Mirka was still surprised by Eaccae's willingness to play the Game of Dares. Eaccae rarely did stunts. And Eaccae always thought the game was too dangerous. With the certainty of a Taranisrise, the uther would remind her of the danger every time she brought up the game. What's changed? Maybe Eaccae thought this challenge was easy, like she did.

Mirka dropped below the umbrella pagodatops toward the base of a titanic cathedraltree. The pagodas' broad leaves forced the trees to grow far apart, leaving enough room for Mirka's wings, though the airspace was still limited. Unlike Eaccae, with its smaller wings, she

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couldn't do much acrobatics in the jungle, less she hit a pagoda.

She neared the first cathedraltree. She folded her wings back, and passed through its open base, neatly clearing the gaps between the tree's five heavy aerial roots. On the other side, she flapped, regaining lost altitude. She heard Mark flapping behind her.

A second cathedraltree neared, one smaller than the first, and with much narrower openings between the roots. Just as her head entered the cavern made by the vaulted roots, she folded her wings. In the darkness of the tree's base, she aimed for an exit even smaller than the entrance. Her wingtips brushed the edge as she sailed through.

She saw the third and last cathedraltree ahead, a gargantuan specimen. She laughed. She could clear this last tree with her eyes closed, and then get on with a more difficult stunt.

She spread her wings wide, and floated between the pagoda's vast roots. Ahead, two fallen pagodas blocked the opposite opening. She blinked rapidly in shock.

"Umph!" She crashed into the higher pagoda trunk. Carrying the narrow pole with her, she tumbled to the ground, unable to breathe because of the pain in her stricken stomach. She rolled onto her back, and stared at the sky as she forced herself to breathe.

Mark flew through the opening she had unwillingly cleared for him. "Ha! You failed!" he said when he noticed her. He rose above the semitransparent pagoda leaves.

Cassie followed. She suppressed laughter.

"Grrr," said Mirka. *A crash! And on a neophyte stunt! Eaccae must think I'm the worst flier around!* "Darn this body!" Mirka stood up. She looked at the limp pagoda trunk. "You stupid tree!" She kicked the dead pagoda. After she checked her wings for damage, she flapped hard and sailed above the pagodatops. Her three companions waited several hundred meters up.

"You failed," chided Mark, "and on the first dare! So that's a big zero completions for you," while gliding, he made an "O" with his thumb and forefinger, "and one for the rest of us."

Feeling cheated, she replied, "I didn't lose! That fallen pagoda shouldn't have been there."

"You know the rules: take things as they come. Eaccae didn't hit the tree!"

"Eaccae's an uther!" She looked at Eaccae, giving it a hurt look. *Why didn't Eaccae warn me?* she thought.

"Regardless, you crashed," said Mark.

"Well, I won't fail the next dare, because I'm going to choose it!"

Mark opened his mouth in protest, but Eaccae whistled, "What will it be?"

Mirka looked around, trying to think of a stunt that would scare the wings off the bravest flier. It had to make up for failing so badly. How'd Eaccae dodge those trees? Amazing. Again she felt a pang of envy for the uther's flying skills. Whatever dare she chose, it'd have to be tremendously, gigantically big to impress Eaccae. She spotted a nearby patch of cloud, one wafting high into the air. Having been taught the powerful forces involved with a developing thunderstorm, she said, "We fly under that cloud." She indicated the white plume by jerking her head in its direction.

Mark looked at her wide-eyed. "You're kidding, right?"

"Are you refusing my dare?"

"Ah . . ." he hesitated, apparently considering her challenge. "It's not fair. You know we're not supposed to fly near storms."

"There're no rules restricting what a dare can be."

"Yes there are. Otherwise anyone could think of a dare that would kill everybody, and win the point when the others refused. That's no fun."

"I'd never dare about something I couldn't complete. That's part of the game—the challenger has to be able to complete the challenge."

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Mark sighed. "But a storm cloud?"

"A little one."

Looking strained, he said, "Okay, I'll do it." He flapped toward the darkening cloud.

Cassie, appearing quite unhappy with the dare, said, "I'm not going. That's a point against me. A wise one, I add." She looked at Mirka with a frown.

Cassie's statement left Mirka with mixed feelings. Sure, Cassie was forced to take a zero, but that tone in her voice. Cassie seemed genuinely disappointed. At a loss for words, Mirka simply nodded.

Cassie banked and drifted away.

Mirka flew toward Mark, catching up—slowly. She paced herself for the kilometers-long trek to the towering white mass that rose over the basin.

Eaccae matched speed alongside her. "Most unwise, this is. Uthers do not fly into thunderstorms, my parent taught me long ago. Only an uther unwise, or an uther desperate, might choose the risk."

"There's going to be some wind, and some rain, but I think we can handle it. I haven't seen any lightning."

"Eliminate entire flocks, small storms have done."

"That's just a legend."

"With basis in truth."

Growing tired of the debate, she said, "The dare's been made. I have to do it."

"Lose the dare better than dead."

"Look, are you coming, or not?"

"Foolishness, I do not."

"Okay. See you soon." She flapped away from her banking friend.

"Go do not," Eaccae called to her. "Stay far-far-far!"

"Hey, Eaccae's leaving!" replied Mark, with some concern. "It refused the dare!" He seemed very worried.

Mirka laughed, though it wasn't as enthusiastic as it might have been. "An uther skipping out on us ground-loving humans. They're weird."

Mark looked at Mirka. "We don't have to do this. If we all take a zero, then we'll be even."

"You're afraid!" said Mirka. She smiled.

"Just wait until the next dare! It'll be my choice then."

"No challenge frightens me."

"We'll see!"

Aided by a weak updraft, Mirka climbed higher.

"What're you doing?" asked Mark, who followed below her.

"Trying to match the base. I said we had to fly *just* below the storm."

"Looks like we're above the bottom."

Mirka looked closely at the cloud. "I'm not sure. I can see many dark bulges."

"Maybe it's sagging."

"Could be."

They flapped for a long time. The cloud grew as they moved closer.

A dark curtain plummeted from the storm's base and spread over the forested terrain like a drop of ink sinking in water. Its misty edge grew outward, developing a large vertical spiral to either side of the rain column. At the spirals' base, pagodas fell by the score.

"Wow!" said Mirka. "Look at all those trees fall. We should be down *there!*"

Mark stared below. "Well, it's not part of the dare."

Amazed at how calm their location remained while such violence occurred below, she couldn't take her eyes from the collapsing pagodas. The contrast was beautiful.

Straight down, pagoda leaves lifted against a rushing gale like upturned umbrellas. The jungle faded in haze.

"The downburst roller is right below us," said Mark.

Mirka thought about his observation. "Makes sense. The dropping air would spread in all directions, not just to the sides."

A strong, cold wind caught her, one full of large raindrops, lifting her faster than she ever could have done on her own. As fast as an uther! "The rain is falling *up!*" she yelled. "And it's still sun-

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ny!"

"We're in the roller!" said Mark with a frightened voice.

This'll work to our benefit, thought Mirka. *The wind's not only carrying us up, but also toward the storm.*

"Look! A round rainbow," said Mark, obviously trying to regain his composure.

"Pretty," said Mirka. She'd never seen a circular rainbow before, and became fascinated with its simple beauty. And she looked *down* on it!

Pulling with greater force, the cool wind grew turbulent. Mirka enjoyed the challenge, fighting for stability where almost none was to be had.

Mark, thoroughly frightened, turned around and fought the face-numbing current. "I'm out of here! Dare or no dare!" Even though the separation between him and Mirka grew significantly, Mirka could tell that the wind still pulled Mark toward the cloud. He wasn't getting out of this dare.

The updraft shifted abruptly and carried them horizontally.

The cloud spread out before Mirka, a huge, black seething base topped by a blinding white tower. The scale shocked her. From a distance the cloud had seemed small. Now it was a billowing, bulging, mountainous blob that reached far to either side. The cloud's white plume leaned over her like a gigantic frosty cliff, filling the sky above. The storm's black base spread beyond her peripheral vision. It seemed to be reaching out to grab her.

"Here we go," she said expectantly. She passed under the leading edge of the storm. Mark, still trying to fly away from her, had grown small, and probably didn't hear her comment.

Taranis winked out. The circular rainbow faded. The black cloud hung above like a great giant about to stomp her.

Ahead, a dark line of scud twisted and tore apart, its ragged edges fading and reforming. *Clouds change* that *quickly?*

The air pulled her down.

Too fast, she thought. She flapped, trying to maintain her altitude, yet the wind outpaced her. Along with Mark, she dropped ever lower, and moved into a frigid rain that suddenly jumped from light to heavy. Water covered her jumpsuit, but she was well protected from the wet and cold by her sturdy clothing.

Another downburst! She whistled the utheran notes for dung, "Do-re-la!"

Raindrops chilled her face, and blurred her vision. She glanced downward, and tried to spot the jungle. She couldn't see anything. She felt as if she were floating in an eerie gray limitless universe. Her stomach had that wonderful funny feeling of falling.

Waterdrops ceased invading her eyes. The rain stopped falling! Suspended in midair, the rain floated around her like countless deformed bubbles.

"This sucks!" Mark's, distant, gray silhouette called through the shroud of precipitation.

Mirka's ears popped. Something moved at the corner of her vision. It had the shape of an uther. *Eaccae?* She looked to the side and saw nothing but the dark veil of rain. She looked for Mark. He was gone. A distant rumbling noise grew with profound intensely.

A huge wash of turbulence engulfed her, sending thick raindrops into her body from every side. She helplessly flapped through the powerful surges. Suddenly, she felt quite alone in this world of lashing gales and soaking rain.

Dazed from a sharp pain in her cold sinuses, and blinded by the stinging rain, she almost didn't notice the approaching pagodatops, their leaves dancing maniacally in a vicious hurricane. With a newfound sense of direction, she flapped hard, trying to keep the ground away from her. *Will Mark see the jungle before . . . ?* Surely he would.

She sailed horizontally above the collapsing pagodas. It seemed that her flapping had almost no effect—she was caught in the downburst's lateral blast. Though hard to judge, she guessed her

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speed was over thirty meters per second, easy.

The rushing wind slowed and gently lifted her high above the swaying forest of cathedraltrees. *Whew! That was a bit scary, but do I have a story to tell!*

Mirka spotted Cassie. She had moved closer to the storm, but still kept a prudent distance. But Mark? She could not see him anywhere.

Maybe he was still in the heavy rain behind her. "Mark!" Mirka called.

Aside from a distant, lonely rumble of thunder, silence greeted her.

She lifted her wristcom and called into its microphone, "Mark Brasseur!"

No reply.

"Life signs, Mark Brasseur." The wristcom responded, showing a rapid heart rate: Mark's okay!

"Give me his location." A map appeared on the small screen, showing Mark's position, still under the storm, but on the ground. "Ping him." Her wristcom started beeping.

She flew back toward the storm, using a strong downward angle to fight the steady breeze. Bouncing in gusty air near the ground, she scanned the broken pagodas for her companion. The tiny beeps from her wristcom increased in tempo as she neared Mark. Rain tapped shredded leaves hanging from trunks that had withstood the gale. The gentle patter added a soothing sound to a disturbingly shattered forest.

A melody reached her ears. "Mirka!" the translator replied.

She looked behind and saw Eaccae race toward her. Upon reaching her, Eaccae spread its flexible wings and slowed abruptly.

"Problem, is there?"

The fact that Eaccae had been watching left a good feeling in her, but one that did not cut through her worry about Mark. "I think Mark crashed."

Eaccae replied, "The whole time, was he near you?"

Eaccae's question surprised her. She had expected recrimination. "Yes. According to my wristcom, he's right around here."

"Search with you, I will."

Mirka nodded. Flapping alongside Eaccae, she scanned the ground.

She flew over a thick pile of pagodas, all of which probably fell at the same time in a massive gust. A small herd of monopedal ceretridons hopped in her direction, their colorful spiny tails bouncing behind long ocher bodies as they leaped over horizontal pagoda trunks. *Frightened by the storm*, she thought. "Or . . ."

Looking toward the horizon, she saw a figure in the distance. "Mark!" She quickly flew to him and landed. Eaccae circled above.

Mark glanced at her. "You didn't hit the ground?"

"No."

"Show-off." He rubbed his right arm, and moaned. "I ripped through leaves, and caught a pagoda in the chest. I nearly broke my arm on the way down."

"Well, that's not too bad," said Mirka, relieved that he had not been hurt worse.

Mark glared at her. "Not too bad? I could've been killed."

Eaccae landed, flapping vigorously. "Mark, need help?"

Mark, looking grim, nodded. "My arm's hurt. I don't think I can fly."

"Carry you back, I will."

"Thanks. Can you really lift me?"

"Certainly, though at my upper limit you probably are. Lift two of you easily, an adult from my flock could do."

Mark looked at Mirka. "Remind me not to fly with you again."

Already feeling bad from the accident, his comment left her depressed. "You didn't have to go!"

"I know. I was stupid. But you didn't have to suggest the stunt. You . . . you're crazy."

"Crazy?" Mirka felt like crying.

"Yeah, you should have heard yourself up in the storm."

She thought about the exciting time

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and said, "What do you mean?"

"My point exactly."

Feeling guilty about Mark's injury, Mirka carefully walked into her home, trying not to alert her parents. They worked in the early morning, and usually were home by midafternoon. Avoiding the foyer, which opened up into the living room and its tall windows, she padded down a broad, arched hall, walking past alien holographic landscapes toward her bedroom. Her wings, folded into a two-meter-tall package on her back, scraped a potted pagoda. She winced.

"Mirka, is that you?" called her mother. She heard a chair being shoved back. Her father had just stood, she realized, probably from the large desk he sometimes worked at, located in an open office that adjoined the living room.

Afraid to speak, she stood still. Maybe they'd decide the noise was nothing.

"Mirka, get over here right now." Dad's words were firm.

She sighed and rolled her eyes. *Here we go again*, she thought.

Staring at her feet, shoulders sagging, she shuffled down the hall, across the foyer and into the living room. Sunlight cast through transparent pagoda leaves outside left pretty olive-green patches on the floor, a scene she normally loved to look at, but one she paid little attention to as she looked up and saw her parents' grim faces.

"We just had a talk with Mark's parents, Mirka," said her father. He sounded very disappointed.

She nodded slowly.

"We've heard their story. I'd like to know what yours is."

Mirka looked up. "What story?"

"Don't play coy, Mirka. You led Mark into a thunderstorm."

"But he didn't have to go! It was just a game!"

"Knowing you, I don't think it was just a game."

Shocked by the words, she stared at Dad open-mouthed.

"You shouldn't have acted that stupidly for any reason."

Mom added, "How could you even think to fly into a thunderstorm when you know they are dangerous?"

"It wasn't that bad. I got a little cold and the wind blew me arou—"

"You were lucky," interjected her father. "Downbursts can and do kill."

"I know," she said quietly.

"I know you know. That's why I'm so shocked. You have demonstrated an astonishing lack of common sense."

She quietly awaited her fate.

"Take those wings off."

Slowly, she removed the lightweight device, her frown growing more pronounced.

Her father yanked them from her hands. "You won't be flying for—for months."

Mirka's eyes opened wide, "But I have—"

"Maybe years."

She shut up.

"In addition, you're confined to your room for the next month, only to leave if your education requires field trips."

The house seemed to close around her. "No one was hurt bad!"

"You're missing the point. You won't fly again until you've shown us that you understand what you did wrong."

She wanted to cry, but felt that it would only worsen things.

"Get in your room before I take away visiting rights for your friends."

Unable to control the tears, she ran to her room and dropped onto her bed face first. A month! No flying. No playing with Eaccae, Cassie, and Mark. She recalled Mark's comment about not flying with her anymore. What about Cassie? Cassie didn't seem all that happy with her when they returned to Weyr. No more fun. She grabbed her pillow and grimly tossed it into the wall.

A soft chime sounded from her crescent-shaped desk. Feeling too depressed

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to talk, she stared at the table until the third tone. "What is it?" she finally said.

"Mirka, you haven't answered in days!"

Sitting up, she looked at Cassie's projected face. Cassie was much more cheerful than she had been.

"I just wanted to tell you about the flying competition that's coming up in a week."

After an initial surge of excitement, her mood quickly became black. "Oh."

Cassie, noticing Mirka's grim appearance, asked, "What's wrong?"

"I'm still grounded."

Cassie gasped. "Oops, sorry. You've never been grounded this long! How long is it going to last?"

"I don't really know. Should be over in about three weeks, but Dad's really mad. I may not fly again."

Cassie looked concerned. "If it'll make you feel better, Mark's grounded, too. He won't be flying for weeks."

Mirka said, "Thanks. But that doesn't get me back into the air."

"I feel bad for you, Mirka. You shouldn't have flown into that thunderstorm."

"Maybe," Mirka said quietly. Mirka recalled Eaccae trying to talk her out of flying into the storm. Was the stunt really as unwise as Eaccae said? Then she remembered the fallen pagodas she had hit when she passed through the cathedraltree. Again, she wondered why Eaccae had not warned her about the hazard. The uther always alerted her to dangers, as it did with the thunderstorm. But not the tree. Strange.

She needed to think about it more. "Cassie, can I call you back later?"

"Sure."

"Thanks."

She stood up and walked to the large, rounded window in her bedroom wall. She stared at the pagoda trees—each one a potential roost that she could no longer go to—and pondered Eaccae's behavior.

Mirka leaned back in her chair, and said, "Zazzy, off." The holographic display hanging over her desk faded away as the quantum computer heeded her command.

She rolled backwards in the chair, hit her bed and slid onto the soft mattress. She flopped onto her back. She had grown tired of reading. No one had visited since yesterday. The computer games were stupid, and her education was going well.

She looked outside. Vivid green pagodas sat under a sunny sky, with a beautifully symmetric volcanic cone behind them. A light breeze rippled the tree's broad leaves, making them look like circular ponds floating in midair. Thermals triggered the wind, she was sure. A perfect day to fly. If she wasn't grounded.

She remembered the last time she had flown on a day such as this. She had soared high above the jungle and sought out blocks of rising air—without the aid of the multispectral goggles that adults liked to use. Flying was more fun when she couldn't see the thermals. She felt so free on that day! She could go anywhere she wanted. She glided all the way to The Fumaroles to the west, where she liked to dive through the steam plumes, and drifted over the western foothills, where the broad Glimmering River flowed. She loved to skim just above the water and follow its sweeping, tree-lined curves.

Just to fly. Even seeking thermals, typically mundane compared to other aspects of flying, was more enjoyable than being stuck in a room. Maybe she shouldn't have gone in the storm after all. Maybe playing among thermals was enough.

Did Eaccae settle for thermals? Not always. The uther could do all sorts of air acrobatics—fast swoops, perfect three-sixties, spinning dives. Eaccae, of course, stayed high up, where such maneuvering was safe. She'd settle for safe if she could do even one of those tricks. But she couldn't. At least not as well as Eaccae. That left storms, and ground-

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hugging dives.

Motion outside her window caught her attention. In the distance, swirling over the cathedraltrees she had dived through with Eaccae, Mark, and Cassie just before her grounding, she saw some kids flapping happily away.

"Opaque," she said, and the window complied, turning a glowing white. She sighed and idly nibbled on loose strands of her hair. Air. She just *had* to be outside! There was no way around it. If she stayed in this room one more minute, she'd go mad!

She bolted upright, ready to spring from the room and—

But, if she broke her confinement and was caught, she'd really be in trouble. Probably years instead of months.

She frowned, and banged the bed with a clenched fist. Trapped.

She recalled Eaccae's strange behavior during the tree stunt for the umpteenth time, and grew uneasy. And that incident with Mark hitting the ground in the thunderstorm—some things just didn't seem to fit his story. Wouldn't he have been more injured than he appeared? After all, she sailed above the forest at a good clip. If she had hit a pagoda . . . best not think to about that.

Mark said he had a hurt arm, but she had seen no bruises or contusions anywhere. Had Mark lied? If so, why? To get revenge? He didn't like her stunt, but that didn't seem enough for him to lie and get her busted. He'd need a strong reason to willingly get himself grounded. Mirka could think of none.

Mirka rolled on her stomach, and remembered the flying competition that Cassie had mentioned. If the race was anything like the last impromptu event, she'd be missing some real fun. And a chance to talk to Eaccae about his strange behavior. Surely he'd be there. Eaccae had always listened to her, even when the uther openly spoke of its dislike for her flying stunts. She must get to the competition. If she had to sneak out, then so be it.

Before she could sneak, she'd have to find out where her wings were. Why not right now? Her parents were away at a TELES seminar. It'd get her out of the bedroom at least.

She bounced off the bed and pulled the soft belt of her robe tight. She stepped toward her door. It opened automatically and she walked into the hall. *Okay, Dad, where'd you put my wings?* she asked herself. *The master bedroom!*

Her stocking-clad feet slid softly on the floor as she walked down the hall to the bedroom. Mom and Dad weren't all that original. She immediately examined the walk-in closet. Nothing but clothes, shoes and junk filling the racks and shelves. Maybe they'd gotten better. She turned to search elsewhere—and halted herself. A smile grew on her face. She spun around and saw a pile of old blankets. Yes!

She eagerly yanked the blankets off, and found her treasure. But how would she get the wings out on the day of the meet? Maybe she'd get lucky and her parents would be away. She couldn't count on that, though. She'd have to make a plan.

She set the blankets back on the folded wings, and stopped after two. What if she couldn't get out? Wasn't this her opportunity now?

Yes! She could fly around for a bit, find Eaccae, and come back without Mom or Dad ever knowing. Smiling, she pulled the covers away and grabbed the wingpack.

She carried the pack to her bedroom, where she slipped into a heavy jumpsuit and some light, warm shoes. She reached for her wristcom, which sat on her bedtable. No. Among its many functions, the device served as a location transponder. Maybe in a fit of boredom, Mom or Dad would check it and find her kilometers away from her room. Or maybe they had set up an AI that checked her location every so often. You never knew with Mom and Dad. She hated the idea of heading into the

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wilderness without the safety of the wristcom. She sighed.

There was no choice. Under these circumstances, she simply could not bring the wristcom along. Besides, she wasn't going far. She removed the device and put it on her desk.

She strapped the wings on, and eagerly exited the room. She ran down the hall, across the living room and onto the balcony. She crouched low and peered through the clear rail. Three uthers flew in formation high above the pagodas. *Is that Adea in the middle?* Maybe. No kids on this side of Weyr, though. Perfect.

She climbed over the rail, tapped the wingpack with her elbow, secured her arms in the expanding wings, and leaped off, laughing from the exhilarating fall. Three days had been far too long! Catching air with outstretched foils, she dropped below the highest canopy, using the foliage as a cover in case any of her friends were above.

Flapping with a fervor gained from many days' grounding, she gleefully dodged pagoda trunks.

The familiar triwinged shadow of an uther, cast multiple times through a series of stacked pagoda leaves, wafted past her. With a start, she tried to turn from a small clearing ahead. Far too close, she flew through, a flash of bright sunlight marking her passage.

"Is that you, Mirka?"

She recognized Eaccae's melodic inflections. Flapping upward, she spotted her friend banking toward her.

"At home, aren't you supposed to be?" Eaccae asked.

Mirka frowned. Eaccae wouldn't do anything about her truancy, though. Uthers rarely bothered involving themselves in human family affairs.

"Yeah," she answered Eaccae, "but my parents are away. I sneaked out."

"Broke your parent's trust, you did?"

"What's it got to do with trust? I was in prison!"

"For your own good."

Mirka tried changing the conversation, saying, "Let's do something fun."

"Two parents, it must be," commented Eaccae.

Mirka asked, "What?"

"Which parent to bond to, you human neonates just do not know. Why there's no trust between child and parent, it explains."

Mirka gave Eaccae a funny look. "What does two parents have to do with anything?"

Eaccae stared back at her. "Breaking trust with my parent, I never consider. How you find it so easy, I wonder."

Mirka shrugged and said, "Does it really matter?"

"With many friends, I can bond . . . more than the confusion created by two parents maybe it is." After a pause, Eaccae said, "A good five-year nursing time you humans need, like we have. Change everything it would do, I am sure."

"Five years of *what?*"

"Suckling. Takes time to develop, a strong emotional bond does. The best explanation for your species' emotional ineptness, a short nursing period seems to be."

"Well, when we're born, at least we don't get coughed up from our mother's mouth!"

"Coming out the other end, how is any better?"

Mirka, unable to think of a response, grumbled and replied, "Are you going to fly with me?"

"Fly with someone who is not trustworthy, and who also endangered a friend in a thunderstorm, why should I?"

Frowning at this unexpected turn of events, she said, "He didn't have to take the dare!"

"True. Still, despite my warning, into the storm you still went. Why?"

Mirka thought about Eaccae's question, and replied, "I've never done it before. It was fun!"

"Your actual reason, are you sure?"

"What do you mean?"

Eaccae paused. "Understand yet, you

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don't."

"Understand what?"

"Yes. Fly with you, I will."

Mirka's eyes opened wide at Eaccae's statement. "Great!" Swiftly flying over her friend, she grabbed the uther around its neck in a dangerous midair hug. "You are my best friend!"

Eaccae gently shook her off. "Hugs! Block our exhalation, they do!"

Mirka, stabilizing her shaken wings, gave Eaccae a sad look. "Sorry. I forgot. We don't breathe through skin pores."

"Only exhale through the skin, we do."

Mirka nodded, hoping Eaccae hadn't changed its mind about flying with her. Mirka timidly asked, "Where shall we go?"

"The Fumaroles?"

"Yes! The Fumaroles are fun!" She eagerly flapped westward, toward the distant, rocky end of Sere Valley. "I've only got a few hours before my parents come home."

Eaccae drifted alongside her. "Bother why, still wonder I."

Ignoring Eaccae's comment, Mirka increased her angle of attack. She wanted good diving distance when they reached the west end.

Mirka gazed at jagged cliffs that rose skyward in front of her. Below, the calm water of moist swampland reflected the cliffs, an image marred by stands of stubby pagodas and bubbleweed. Small forests of wicked-looking spiny pagodas stood among the talus piles along the cliff's foot, some constantly awash in white steam that billowed from small vents along the shore. Large fumaroles kept the pagodas at bay with hot blasts, making them look like miniature, empty-sloped volcanoes.

This was as good as any time to ask Eaccae about his strange behavior during the stunt game. "Eaccae, why didn't you warn me about those blocking pagodas when we were flying through the cathedraltrees?"

Eaccae looked at her. "Catching on, you are." He seemed more cheerful. "But, tell you why, I can't."

Shocked by his cryptic words, she stared at him. "Why not?"

"Fail will I, then."

"Fail? Huh?"

"The Fumaroles, we are at. Waste time talking, we should not. Follow me! Near-near-near!" Eaccae flapped hard, shooting ahead of her at a disturbingly fast pace.

Mirka, feeling a familiar jealous pang, said, "Hey, wait up!"

"Near-near-near!" urged Eaccae.

No reason to refuse some fun. She pointed downwards, and flapped quickly. Eaccae flew through a lazy steam plume ahead of her, and faded behind the lazy wisps. Twin swirls of wingwash marked Eaccae's passage. Stinky, hot, humid air burned her nose as she passed through the cloud. Unable to resist, she banked and flapped through several more steam plumes. She enjoyed the searing washes. She saw Eaccae lift above a small pagodalot ahead. The uther shot toward a series of pinnacles that stood high above the surrounding foothills. Mirka followed. She made sure to fly through the forest that Eaccae had left, and dodged a series of heavy, twisted leaves and broad, contorted stems.

She flapped above the woods, banking towards the rocky spires. Eaccae had already reached the stone exposures, a clear demonstration of the uther's unattainable speed. Without slowing, Eaccae circled the spire, and gained elevation with each orbit. Mirka grew resentful. Why did Eaccae do such flying now, during the only time she would fly for weeks? Was the uther rubbing it in?

Gaining altitude, but not much distance above the mostly barren hillside, she neared the first pinnacle. Spiraling around the rock as tightly as she could, she rose towards its narrow top, following Eaccae's path. At the peak, she breathed hard from her efforts. Eaccae dropped behind the pinnacle, skimming

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just in front of a broad cliff near the mass of rocks. Mirka rested her tired muscles, and glided toward the new challenge.

She banked around the pinnacle's side, and pointed straight at the jagged stones below, trying for the fastest speed ever. She'd catch Eaccae!

Hard, angular rocks rushed by either side. Wind whistled loudly in her ears as she reduced the angle of her descent and followed a steep-sloped creek. Shaded by the cliff's own bulk, many of the exposure's hazards were hard to see. Mirka barely missed a protruding rock. Her wingtip scraped an unyielding chunk of cliff. She darted above a boulder that had wedged between the two walls.

The narrow canyon opened up to a rocky slope that dropped down to the vast, misty swampland. A large pagoda forest grew along the base of the rugged alluvial fan. Eaccae faded into the canopy.

Sweating profusely, and barely able to control her breathing, Mirka followed the slope. Sawblade-sharp rock that supported a few spiny pagodas flashed below her, blurred by the rapidity of her motion. Eaccae didn't exit the pagoda stand. The uther should have passed through in seconds. *Did Eaccae stop this insulting game?* she thought.

As she neared, the pagoda stand's crescent shape seemed to reach out and engulf her like a giant pincer. Eaccae still had not exited. She pumped her wings harder. *Maybe Eaccae's playing aerial hide and seek*, she thought, hoping that the uther was done outflying her. She flew past wind-torn pagoda trees and sank into the dense forest. Thin-stemmed sentinel trees and thick-trunked cathedraltrees held a multihued ceiling of green above her. Sunlight passing through the semitransparent leaves cast green pie slices and pincushion triangles on an understory of red and blue globe pagodas, muting their vivid colors. Water glittered under the globes' spherical leaves. Stubby neopagodas grew among the weeds, looking like orange five-branched umbrellas.

A sour smell overpowered the septic pagoda scents. She winced. *Must be a fumarole*, she thought. She followed the odor. Nothing like a little fun while finding Eaccae. She banked around the symmetric limbs of a tall Birchian brancher, and spotted wraithlike clouds of steam wafting through a mix of pagoda trees ahead. She smiled. With so much steam, the fumarole must be big.

She moved into the vapor. Muggy, burning air attacked her face. The stench seemed to sear her nose, and she sneezed. Her eyes stung. She blinked so often, she could barely see. The steam thickened and she could see nothing but gray, enhancing her sense of blindness. Tall pagodas rarely grew near fumaroles, so she maintained a steady pace. A breeze flattened the steam plume, revealing the forest ahead. A wall of strangely canted pagoda trees blocked her path. She gasped. She cupped her wings as she tried to slow.

The leading trunk caught her square in the face. The tree's soft osmotic myoskeleton splattered, and covered her abused cheek with sticky fluid. She slid past the tree and tumbled into several more pagodas. She banged her shoulder and back. Her flailing wings cut through strands of helicopter vine on the way down, each making a loud pop as it broke. Leaning pagodas sprang upward with a loud whoosh. She looked down: the ground raced toward her. She screamed "Ouch!" even before she hit. Y-stem and globe pagodas bent and snapped under her. She plunged into tepid water.

Winded, she lay on her back, her wings outstretched, as she slowly sank in the bubbleweed-filled water. She stared at the flailing pagoda trees above, eyeing the limp helicopter vines that dangled from their straightening trunks. Other pagodas still leaned over her, blocking her old flight path. Taut helicopter vine stretched from sturdy cathe-

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draltrees held the pagodas at strange angles. *Did Eaccae do this?* She released an arm from its wing and rubbed her bruised face. *Why would Eaccae hurt me?* Angered by the thought, she bolted upright in the knee-deep water.

"Fly! Far-far-far!"

The urgency in Eaccae's singing sent her heart racing. She turned. Eaccae darted toward her. Had the uther gone mad?

A greenish-brown bulbous shape erupted from nearby vegetation and jumped at her. She screamed as she leaped upward—but one arm was not in its wingstrap, and she didn't get far. Eaccae passed between her and the airborne springcroc. With heavy, armored jaws similar to an Earth clam, the springcroc engulfed Eaccae and dropped into the water, tossing a glittery wave high into the air. Leaping with its single heavily muscled leg, the titanic springcroc sailed toward the forest periphery with Eaccae's wingtips hanging from its mouth.

Mirka shoved aside the anger she had toward the uther, and lifted her wrist to call the TELES rescue team—and then remembered that she had left her wristcom behind. *Do-re-la*, she thought, and she regretted her desire to sneak outside. She had to fly home to alert the rescue team. She secured her arm and flew above the jungle. Weyr was so far away that its familiar observation towers could barely be seen through the haze.

Eaccae couldn't survive the time it would take her to reach help. Mirka flapped toward the broad alluvial fan that they had flown down. She dropped onto the loose rock, and hurriedly sought out a big boulder. She grabbed a stone that she could just hold with her legs. Flapping hard against the heavy load, she skimmed the rocky slope back to the forest.

She reached the pagodas and plunged into the water, dizzy from her tiredness. She slid her arms out of her wings, and the foils folded up behind her. She grabbed the rock with both hands, and swished around the marsh looking for the springcroc's trail. She found crushed bubbleweed and snapped y-stem. She followed the signs. Her legs made deep slurping sounds, and occasional bubbleweed leafs underfoot produced muffled underwater snaps. Water rose to mid-thigh, slowing her to a painstaking crawl.

An exotic collection of ruddy head-tall globe pagodas clustered before her. The red globies grew so thickly that she feared she wouldn't find the springcroc—not even if she had the energy to search from the air. Her feet stuck in the mud, slowing her even more. "Eaccae!" she called.

A swishing sound emanated from behind some canted red globies. Stepping in the direction of the noise, she looked through the pagodas and saw Eaccae's exposed wingtip twisting from between the heavy, armored "lips" of the gigantic springcroc. The huge animal lay quietly before her, its table-sized bottom only half submerged in the warm water. Little time remained before the digestive fluid killed Eaccae. Mirka stepped forward and heaved the heavy rock at the springcroc's shell. The stone bounced off. The springcroc jerked backwards. A bright white scrape in the pseudoalgae that camouflaged the ancient beast was the only sign that she had struck the beast.

"No!" she screamed as she slammed the rock into the springcroc's shell again, sending a brilliant white chip spinning into the pagodas. Her makeshift hammer also cracked. A number of small pieces rolled down the shell and plunked into the water.

Eaccae's wingtips stopped swishing.

Mirka gritted her teeth and held the rock high over her head. Clunk! The stone bounced away from the shell, leaving a new scrape, and throwing off more of itself. One piece flew up and landed on top of Mirka's head. She rubbed the new wound. The stone would disinte-

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grate before she broke through the shell. The lump on her head gave her an idea.

She held the stone just above her knees, hit the wingpack with her elbow, slipped her arms into the opening foils, and leaped up. Flapping hard, she rose above the tallest pagodas.

The springcroc seemed satisfied that its shell was good protection. The feasting 'croc made no move to run away, and became a tiny circular shape among the noise of plants below. Remembering what Mark had told her about targeting water balloons, Mirka hovered above the springcroc in a vertical position. She looked just above the top of the rock, trying her best to judge a straight path downward. The tall, skinny stems of a few sentinel pagodas offered a good comparison. She moved and traced the imaginary line's endpoint over the ground to meet the springcroc. Dearly hoping the impact would not injure Eaccae, she let the stone fall.

Shrinking abruptly, passing through the pagodas' eerie colored shadows, the rock smacked into its target. Opaque fluid, broken shell and shattered rock fanned out in a glittering circle.

Mirka closed her wings and fell, only flapping at the last moment to soften her landing. She freed her arms. Her wings closed.

"Eaccae?" Walking over to the bowl-shaped bottom hemisphere that still contained her friend, she saw the uther's unmoving form bathed in slimy digestive fluid and covered in jagged bits of cracked shell.

She grabbed Eaccae's wing and pulled at the uther, grunting as the heavy body slid from the springcroc's half-mouth. The mortally wounded springcroc leaped upward and fell to its side in some kind of death twitch, helping Mirka remove Eaccae from its insides. Eaccae gently floated in the water. Tiny streams of bubbles exuded from the uther's skin, an indication that it still breathed, though weakly. The slime and water that covered Eaccae might eventually cause suffocation. Mirka urgently looked for dry land.

She felt pressure on her calf, then pain. Looking down through the water, she saw a small springcroc clamped to her leg. Sudden motion among the pagodas revealed many more mini-springcrocs swimming toward her. One leaped and snapped down on Eaccae's wing.

The springcroc she had killed was a mother!

Mirka supressed her guilt—this was no time to become a springcroc-lover. She kicked at the kidcroc on her leg, and only achieved more pain as the beast tightened down. Another one-legged clam jumped and chomped on Eaccae's tail. The two kidcrocs on Eaccae tried submerging, but the uther was too large. More kidcrocs approached. Soon they'd swarm Eaccae, and all would be lost.

Mirka looked for her rock, then recalled that it had shattered with the mother's shell. She studied the vegetation. Soft pagodas weren't a decent weapon against the marauding babies. But there was nothing else around. She grabbed a shoulder-tall pagoda and yanked it from the ground. Waving the springy staff and hobbling forward, she yelled, "Get away! All of you! Go, go, go!" She swung at the kidcrocs with the flexing stem and shredding leaf. The babies swam back a few meters, and watched her with their numerous stalked eyes, each orb a gleaming pearl wiggling from the seam of the two shell-halves. They did not leave.

Mirka's breaths grew ragged, and she shivered from fear. She looked at Eaccae. What could she do? If she flew away to get help at the colony, or to retrieve more rocks, the kidcrocs would certainly find Eaccae an easy meal. However, they'd soon realize the harmlessness of her pagoda weapon.

A burning sensation grew on her springcroced leg, and a sharp, searing pain almost made her collapse. The

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strength of the little legged clam was surprising. She slapped the kidcroc with her pagoda, sending huge gouts of sparkling water high into the air. She hit the 'croc several times without effect. Her arms, already worn from so much flying, quickly tired. She stopped swinging the stem, and tried to catch her breath. A number of babies moved towards her, swimming just below the surface. Feeling dizzy, Mirka readied her abused pagoda stem.

A dark, heavy shadow passed over Mirka. She looked up. "Adea!"

Adea splashed next to her, almost pushing her over with the gusts from its powerful flaps. With a flick of its arm, Adea grabbed a croc-popper from its netlike tool belt. Adea shoved the croc-popper straight outward, cut cleanly through the water, and plunged the beveled tip into the back of the springcroc on Mirka's leg. Adea twisted the weapon. There was the sound of scraping bone and tearing muscle, then a sudden "Pop!" The baby springcroc fell away from Mirka's calf, its shell-halves neatly separated.

Adea turned and quickly popped the two beasts sucking on Eaccae. The giant uther scanned the litter of kidcrocs waiting in the pagodas. Adea stood high on its fluke, and flapped its wings. The globies swayed under the force of the wind. Waves rippled across the water. The remaining kidcrocs leaped far into the pagodalot, and disappeared.

Adea sheathed the croc-popper, turned to Eaccae, and delicately touched Eaccae's barrel-like torso. "Survive Eaccae will. Slow, recovery will be." Adea lifted Eaccae from the pool. Waterdrops plunked from Eaccae's limp wings.

Mirka rubbed her hurt leg, and said, "Where'd you come from?"

Adea glanced at Mirka with a large glittering eye. "Sneaking from your home, I saw you, and finding Eaccae. Making an effort to teach you Eaccae is. Something like this might happen, I feared. Much to learn, Eaccae has to do."

Mirka looked at Adea quizzically. "Eaccae never mentioned teaching me."

Adea looked at the behemoth that Mirka had destroyed, and said, "Rough, but successful. Croc-popper there may be in you after all."

Feeling good, Mirka said, "Thanks."

Adea shifted its gaze back at Mirka. "Though your foolishness, it shows me also."

Mirka immediately felt ashamed, and she looked at the ground.

"Eaccae's messages you have not learned from." Adea launched, its massive wingbeats tossing the globies into a furious dance.

Mirka followed. "What messages?"

Adea looked at her with an emotionless eye. "Too challenging for a neonate like Eaccae you may be."

"I didn't tell Eaccae to go in the forest!"

"You did, in a way. Required it was of Eaccae, to teach you." Adea flapped hard, leaving Mirka behind.

Silenced by her guilt, Mirka watched the receding eyes of Adea's neonate as it scanned for aerial dangers.

Mirka leaned on the smooth rail. She stared at a pagoda jungle filling with shadow as Taranis set behind a distant, snow-clad volcanic peak. Two weeks of being respectful had earned her the privilege of balcony visits.

Now that she'd given up flying, she had nothing better to do than concentrate on education. Then stare longingly at the jungle every evening. Her thoughts had always been the same each sunset.

What did Adea mean when it said that she hadn't learned from Eaccae's messages? And other conversations came to mind, like when Eaccae had suddenly agreed to fly with her despite her thunderstorm stunt. What did her friend mean by "You don't understand yet"?

And who tied all those pagoda trees into her flight path?

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Eaccae.

Eaccae was the only one at the fumaroles—save for Adea. Adea didn't know her well enough to guess that she'd fly through a steam plume. Mirka felt a pang of envy. To tie down so many pagodas in such a short time, Eaccae must have done some amazing flying. But why would Eaccae want to hurt her? Her face and back ached for days after hitting those pagodas. She suddenly felt angry at Eaccae. Had the uther also lured the springcroc toward her?

No, Mirka thought, *Eaccae wouldn't go that far.* Eaccae had risked its life to keep that springcroc from getting her, and almost lost. Considering the uther's selflessness, she found it difficult to stay angry at Eaccae.

She sighed and leaned back. She saw an intense "star" almost straight overhead. The watery planet Sucellis, the next step out from Taranis.

What would she do when she completed her grounding? She could hike. Maybe. Now that she had witnessed a springcroc in action, hiking through the pagodas wasn't very appealing. And she had thought that Eaccae was just being too cautious about flying low. Foolish indeed!

An uther flew far overhead, having passed over the colony arcology. "Eaccae!" What luck!

Eaccae banked and smoothly landed on the balcony next to her. "On the balcony, you are allowed? Talk we can, then?"

Mirka glanced through the window, checking to see if her parents were in the living room. Yep. They didn't seem to mind Eaccae on the balcony. "Yes, though I can't leave the house."

"You look really good!" Mirka added, excited to see Eaccae flying again.

"Yes. Heal fast, we neonates do."

"Great." Mirka, unsure how Eaccae felt about her, couldn't think of anything else to say.

"Saved me from the large springcroc you did, Adea said."

Mirka nodded. "You saved me as well."

"Nevertheless, watch out for you I will, like a neonate does for its parent. When you fly again, dangerous surprises I will find for you."

Did she detect apprehension in Eaccae's words? Hard to tell with a translator. "I won't be flying again." She couldn't keep the edge off her voice.

Eaccae jerked its head sideways and looked closely at Mirka. "What changed?"

She heard nothing to show that Eaccae cared about her flying again, and she frowned. "I don't quite know," she said slowly. "I understand that I somehow provoked the springcroc attack."

Eaccae replied, "Intend, I did not, for the attack to happen. Had I seen the springcroc, my message I would have destroyed, and leave the forest immediately I would have done. However, captured my intended message from the unexpected attack you have, so happy that it happened I am."

"What do you mean by captured the message? How could you be happy about a springcroc attacking you?"

Eaccae thought about her questions a moment. "Reaching subadulthood I am, and learn the ways of adults I must do. My instructor Adea is, for teaching the language of situations. You I chose, for my first subject. Concerned about my choice Adea was, but he agreed."

"Why me?" Mirka asked.

"Read my messages better, I wish you could." Eaccae paused. "Bothered by my flying ability, you seemed to be. Anger you, my flying did. Accepted your humanity you haven't done. To be one of my kind, you seemed to want, to my shock."

A nervous twinge erupted through her stomach as she heard the words. Did she really respond to Eaccae that way?

"Humility seemed to be the right thing to teach. Though, choose the most efficient method I did not, considering your bold nature. New I am at this form

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of speech. My lesson I have failed for telling you this."

Mirka shivered. "Your traps could have hurt me bad." Why were Eaccae's words so bothersome?

"Danger I realized when I saw you crash the second time. Apologize I do, for the crudeness of my messages. Many years it takes to perfect the art."

Mirka could have missed some of Eaccae's situations. "How many times did you try those messages on me?"

"Three."

"The cathedraltree was one, and the fumarole two. What was three?"

"Mark's thunderstorm fall."

"Wait," said Mirka, "I can see you blocking the cathedraltree and tying down pagodas, but you can't control a storm."

"Making another message so suddenly after the first I had not expected. However, opportunity, I saw with the thunderstorm. Easy it was to tell Mark my plan after you two became separated."

The movement she had seen in the storm *was* Eaccae. "But you said flying into a storm was unwise."

"Worth the danger, the opportunity was." Eaccae paused before saying, "Desperate I felt, after my first message motivated you to do more dangerous stunts."

So that's why Mark didn't look injured! He was *faking!* She felt betrayed. "How long has Mark been in on this?"

"After you followed Adea on the croc-popping hunt. Talked to Cassie and Mark I did before intercepting you on your way back to Weyr. Agreed they did that good my intentions were."

"Friends don't do things like that to each other!"

"Disagree, I do. Help one another, friends should do."

Mirka eyed Eaccae angrily. "Getting me in trouble is not what I call help!"

"If working it is, help how can it not be?"

"What do you mean?"

"You said that flying anymore you do not want to do. Accepting yourself, you nearly are."

Still fuming, Mirka nevertheless asked, "When will I be there?"

"Angered you, I have done." Eaccae jumped onto the railing, stretching its wings in preparation to leave.

"When!"

"When you fly again." With a single, slow flap, Eaccae drifted from the rail. "Fly with you then, I look forward to."

An urge to cry overtook Mirka.

Walking home from a recent hydroponics field trip, Mirka saw Mark just ahead of her in a cluster of classmates. Angry, she stomped up to him.

Poking his shoulder roughly, she said, "Why did you do it?"

Mark, briefly looking surprised, replied, "You needed it."

Shocked at his words, she said, "What?"

"Stunt flying is one thing, but constantly showing off is another."

"I did no such thing!"

"Yes, you did. When you were around us, it only came up a little, but when Eaccae was there, you went crazy. No amount of your own stuntery seemed to please you."

Recalling the last times she flew, she couldn't deny Mark's claim. Embarrassed by her actions, she said, "I . . . I . . ."

"You made it quite clear that you were jealous of Eaccae. At first it was kind of funny, then, after awhile, it became obnoxious."

"Obnoxious! You and Eaccae can just—"

"Look!" Mark interjected. "You have no right to be angry. Eaccae was trying to help. You should thank Eaccae for its concern."

Mark's statement silenced Mirka. She turned and walked slowly away, holding her arms crossed. *That's what Eaccae meant by teaching me humility!* she realized. "I didn't know."

How could she have been so insensitive? She wished she hadn't gotten angry

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at Eaccae the other day, and dearly hoped the uther would forgive her.

"Come on, Mirka," pleaded Cassie over the holophone, "I miss flying with you."

"Even though I did all those crazy stunts?"

"Yes."

Mirka looked at her wings, which lay against a wall, folded neatly. Despite her vow never to fly again, she really wanted to do so. She glanced out the window, saw clear skies and bright sunshine. A light breeze shuffled the pagodas. A perfect day for flying.

Looking at Cassie, she said, "Well . . . OK. For a little while."

Cassie smiled. "Great! I'll see you on the top balcony."

As Cassie's image faded from sight, Mirka grabbed her communicator and slid it over her wrist. *Never again will I leave this behind!* She stood up, grabbed her wings and strapped them on. Before exiting the door, she hesitated. *What would Mom say?* It shouldn't matter—she was no longer grounded. She walked into the living room.

Mom looked up from the couch. "Mirka, you're wearing wings."

Mirka looked at her. "I'm going to fly with Cassie."

"Didn't you say you wouldn't be flying again?" Mom had a mischievous smile.

"I've thought about it. I was too hasty in my decision."

Her mother chuckled. "Be careful."

"I will. No more stunts for me!"

Looking surprised, Mom asked, "What brought this on?"

"Eaccae taught me a few things."

"Is that so? Uthers being better teachers than a child's mother . . . And I hoped this latest grounding served some good."

"I've learned from it, too," she said, to make Mom feel better.

Her mother winked. "I'd like to talk to Eaccae one day. Seems like that uther might have something to teach me."

Mirka smirked and said, "I don't think you'll find Eaccae's way easy to learn. It still confuses me."

After giving Mom a quick hug, she walked onto the balcony. She breathed the moist air deeply, revelling in being outside, being free. She stepped onto the rail and dropped toward the thick pagodas below, and enjoyed the long unfelt falling sensation. She opened her wings far above the pagodas. Flapping casually, she headed for the observation dome roof.

Eaccae greeted her halfway up. "Mirka, flying you are!"

"Yes!"

The uther bellowed in excitement.

"I'm sorry for getting mad at you," Mirka said.

"Apology accepted. Some animosity, I had anticipated. Cause the same reactions in my own kind, situation talk can do."

"Do you want to fly with Cassie and me?"

"Certainly. On the top balcony, I saw her," said Eaccae, and with a swift wing motion, immediately shot above her at a speed that she could never hope to attain. The uther's wingwash buffeted her strongly.

Mirka felt a twinge of jealousy toward her companion for its flying ability. *Why bother worrying about it?* she asked herself. She could still have fun flying even if she couldn't achieve the capability of an uther. Feeling a sense of calm she had never experienced while in the air, she climbed at an unhurried pace.

"I'll see you there!" she called to Eaccae. ■

(EDITOR'S NOTE: This story takes place about ten years before "Duel for a Dracowolf" [November 1998]. You can also read more about the planet Epona in the author's special feature "Epona" [November 1996] and in G. David Nordley's "Fugue on a Sunken Continent" [November 1996].)

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Navohar, Hilari Bell, ROC, $6.99, 330 pp. (ISBN: 0-451-45788-9).

Tales of Old Earth, Michael Swanwick, Frog, Ltd., & Tachyon Publications, distr. by North Atlantic Books, $25, 277 + xii pp. (ISBN: 1-58394-016-2).

Dark Matter: A Century of Speculative Fiction from the African Diaspora, Sheree R. Thomas, ed., Warner, $24.95, 427 + xvi pp. (ISBN: 0-446-52583-9).

Mardi Gras Madness: Tales of Terror and Mayhem in New Orleans, Martin H. Greenberg and Russell Davis, eds., Cumberland House, $12.95, 239 pp. (ISBN: 1-58182-077-1).

Robert A. Heinlein: A Reader's Companion, James Gifford, Nitrosyncretic Press, $24, 282 + xxii pp. (ISBN: 0-9679874-0-7).

Borderlands of Science, Charles Sheffield, Baen Books, $22, 367 + xvi pp. (ISBN: 0-671-57836-7).

In one of the traditional strains of science fiction, an outsider visits Earth to say something like, "Gee, you guys do a lot of dumb things." In a variant, the outsider comes to some other world, but the dumb things are the same ones we are guilty of right here at home. The outsider can be a human, an alien, or a robot, a traveler in time or space or alternate realities. In general, there is a sense of vast superiority and righteousness and very little reciprocity.

Trust Sheri Tepper to correct that deficiency in **The Fresco**. The star is Benita Alvarez-Shipton, intelligent and practical and determined. Her past is unfortunate, for she married young and hubby Ben Shipton turned out to be a boozer and an abuser. Now the kids are grown, with Angelica on the college escape track and Carlos just like Pop. Benita is ready for a change when two aliens—Vess and Chiddy of the Pistach—step up to her, hand her a wad of cash and a message-bearing cube, and ask her to take the cube to her leaders.

"Why not?" says Benita, and off she goes to become embroiled in a political brouhaha such as the world has never seen before. The Pistach are civilizers, bent on teaching alien civilizations the principles of Tassifoduma or "neighborliness" so that they can join the Confederation. "And by the way, once you're in, the predators among us have to keep their paws off. If you don't qualify, or if you refuse, you're fair game. Though, of course, the rules don't permit them to eat all of you."

The Pistach don't know it, but Tepper does: The predators are already here, they think Earth would make a very nice hunting ground, and they're talking to corrupt politicians about hunting rights, as well as about catching Benita and stopping the civilizers.

Meanwhile, Vess and Chiddy are Doing Something about assorted varieties of human folly. They're strong on poetic justice too, as shows when they take a look at Afghanistan's Taliban, which sequesters women on the grounds that if a man sees them he will become inflamed with unholy lust. Solution? Make them

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the ugliest creatures this side of the High Seat of Hell. Lust is no longer a problem, and once the message sinks in—treat your women better, and they'll get pretty again—the Taliban men in fact come around.

Add in gadgets (causeometers) to help the cops tell when they have probable cause to haul someone in, guns that shoot the shooters, a solution to ethnic discord, and more, and soon Tassifoduma is breaking out all over while the predators—both human politicians and alien hunters—vigorously gnash their fangs.

Where's the reciprocity I mentioned? The civilizing ways of the Pistach are rooted in a long history commemorated in a fresco painted on panels in a hilltop temple. The fresco itself is so stained by millennia of smoke from votive candles that no one within living memory has actually seen it; modern belief, philosophy, and practice are based on descriptions and interpretations of the panels written down by an ancient wise one. Intriguingly, Chiddy once accidentally cleaned a portion of one panel and revealed a bit of detail than didn't match the descriptions. Rather than seek truth by cleaning the rest of the fresco, the Pistach authorities sooted the clean bit up again and carried on with business as usual.

In other words, the Pistach share a very human preference for myth and tradition over objective truth. They are as vulnerable when a rebel, encouraged and equipped by the predators, shows up with a scrub brush as humans are to the Pistach civilizers.

But as far as the Pistach are concerned, humans are outsiders. They too can have practical, helpful insights—they just can't apply them to their own problems! (Or they can—but no one wants to listen.)

You'll have fun with this one. Benita—woman, minority, uneducated, victim—is a worthy protagonist who stands for all that is genuinely good about people. In her service, Tepper displays a marvelous sense of humor and deploys enormous writerly skills to keep you happily turning the pages.

Suzanne Allés Blom tells us that she was always irritated by Pizarro's easy conquest and looting of the Inca Empire and enslavement of its peoples. Could it have turned out differently? What might have made it do so? How would events have then proceeded?

The result of her ruminations is **Inca: The Scarlet Fringe**, the first in what looks to be a very interesting "alternate history" series. When the Spanish first met the Inca civilization, they stayed just long enough to grab the gold within reach and collect three locals as samples. When they departed, they left behind two crew members, of whom history says very little. Blom posits that instead of getting involved in the civil war that weakened the Incas and facilitated the Conquest, Atahualpa (here, Exemplary Fortune) set off at the behest of his Emperor father to investigate the strangers. He collects the two left-behinds, naming the fierce, intransigent one Tamed Ocelot, and is soon convinced that the Spanish are a serious threat. On the way back, he hears of his father's death and promptly heads for the capital and the new Emperor, a disliked brother. He expects to lose his head, but his loyalty to the Empire comes first. The Emperor must know what is coming.

Happily, the Emperor doesn't kill him. Instead, he sends him into exile on the frontier with Tamed Ocelot, assigned to learn all he can. Atahualpa successfully overcomes a number of problems in his new home, sets Tamed Ocelot to work teaching Spanish fighting styles to Inca troops, and in due time is summoned back to the capital to report. He arrives just in time for the return of the Spanish. His advice is needed. So are his newly trained troops, but they are far away. The Incas must face the Spanish with

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only their usual forces. Fortunately, they have not been weakened by civil war.

The ensuing battle is not decisive, but it is enough to mark a new path for history. On that path, I expect, there will be further confrontations, and Atahualpa's new troops will play a major part. The Empire will not fall. Perhaps it will spread rapidly, following its traditional pattern of conquering neighboring tribes, teaching them Inca ways, identifying their unique talents, assigning them a special role in the Empire, and moving on. On the pattern sketched here, those Inca ways are a very civilized alternative to Spanish barbarism. If Blom has her Incas reach across the sea to Europe, the result could be a remarkably civil global society in later centuries—perhaps even a society that doesn't need the Pistach lessons in Tassifoduma.

Maybe. But though the Incas did have a remarkable civilization, they had a dark side that shows in their propensity for human sacrifice. Blom doesn't mention that, apparently preferring to cast them as thoroughgoing nice guys in contrast to the evil Spaniards. Nor, I think, does she give sufficient weight to the devastation wrought by the epidemics that followed the Spanish arrival (in Mexico, a 1520 smallpox epidemic killed as many as half of the natives). Such things weaken the tale.

But still . . . Blom's simple, straightforward prose carries the reader effortlessly along despite the wealth of strange names, and the premise is extraordinarily intriguing.

Sean McMullen made a splash with *Souls in the Great Machine* (reviewed here in November 1999). His premise was a world brought low by global warming, an orbiting sunshade gone awry to produce a Greatwinter, orbiting battle stations that destroy electronic devices and powered vehicles above a certain size, and the Call, a periodic psychic summoning that pulls people and large animals—but not birds—toward the sea and their deaths. Two thousand years hence, civilization is struggling to rebuild, and in Australica a genius realizes that a computer can be built from repetitive operating units, and that the units need not be mechanical or electronic. They can be people—the souls in the machine. So a "calculor" is built, empire swells, and opposition arises. Indeed, some of that opposition has enough of bird about it—genetically engineered into their ancestors an age ago—to resist the Call. These "aviads" can act when normal humans are quite non compos, and they have factions that wish to use their advantage to rule the world. In *Souls*, they were beaten.

It is now years later. The scene is western North America, where the realm of Mounthaven enjoys a chivalric code built on airlords and wardens flying diesel-powered gunwings and sailwings instead of armored knights on horseback. Disputes are settled by Snoopy-vs.-Red Baron duels, and wars are more like group duels than pitched battles.

As **The Miocene Arrow** begins, trappers shoot down a mysterious aircraft, whose crew escapes. Soon we realize that there are abroad in the land those who can resist the Call—including one major character from *Soul*, Juan Glasken. Special tram cars are being built and fitted out with calculors. A secret army is being raised. The land of Bartolica is attacking its neighbor Yarron with all the grace and kindliness of a Serbian wolf, and all the code of chivalry is out the window.

It is soon clear that the carnage is being masterminded by agents from Australica—aviads who wish to take home the technology of the gunwings to help them conquer the world. It is being resisted by other agents, including Glasken. But though Glasken and his allies can help, it is the flyers of Yarron—led by the vengeful super-ace Serjon "Warden-Killer" Feydamor—who must become heroes and turn the tide. The

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traditional American spirit of innovation helps a bit too.

That Serbian wolf provides a good deal of motivation. So does romance, which tends to confuse and complicate life for the boneheaded, superstitious Serjon. The combination gives McMullen's tale immense momentum and guarantees a classic "good read."

The book's title remains a mystery for most of the tale. As it turns out, it refers to the aviads' secret, ultimate weapon, which hinges on the source of the Call: "cetozoids" cloned from a whale carcass found frozen in Antarctic ice in the last days before the fall of our civilization. They were intelligent, you see; they lived millions of years ago (in the Miocene); and they destroyed themselves in war. I'll tell you no more, except to say that weapons can be used in more than one way.

This is a good one. Enjoy!

According to Hilari Bell, Earth will be invaded by the Vrell, the evil slavers of the galaxy. Humanity will resist and in due time win by loading their own genes with a virus that will emerge from the captured slaves to infect and destroy the Vrell. Unfortunately, the same virus will devastate Earth's ecosystems to the point that humans can survive only in domes. And the people themselves will start falling prey to the disease.

Prior to the disaster, some folks chose to get the heck away from Earth, using Vrell technology to find and colonize distant planets. Now Earth wants to find them, for their intact genomes hold the only hope of saving the species (somehow the virus-makers neglected to keep a few pre-virus cell samples in the freezer, and the icy vaults of the cryonicists must have been lost). Unfortunately, every single colony investigated has succumbed to local diseases and is extinct.

Now here's **Navohar**, the latest hope. The colony buildings are empty but strangely dust-free. There's no sign of people—until someone takes a shot at Mark in his hover-chair (he's a virus victim). Oops, sorry about that, we goofed, and how are folks back home doing these days, anyway?

Mark gets sick. Irene, his aunt and one of the researchers who created the virus way back when, gets upset when the locals kidnap him. She follows, has an accident that damages her sealed envirosuit, and starts to get sick herself. One of the local camels—two humps and six-legged—takes her to a pond and pushes her in. She gets better. When she eventually finds Mark, he's better too. In fact, he doesn't need a hover chair anymore!

Whoa! The locals have just what Earth needs. But they don't want Earth to know about it; they quite reasonably think Earth would invade and rather spoil the place. So it's up to Irene to try to figure out what the cure-all is and how to reproduce it in a lab that can be taken home.

Unfortunately, there are complications. The leader of Irene's expedition is a greedy SOB with no sense of the rights of other beings, intelligent or not. The leader of the locals is arousing Irene's biases. And the cure-all itself . . .

No more. Read it yourself, and enjoy the tale. Bell has done a nice job if you can get past the foolishness of Earth researchers not keeping samples of human cells in their original state. Or, for that matter, not keeping the results of the Human Genome Project on file; the announcement that almost the entire human genetic blueprint has now been deciphered came just this week (as I write this), but the Project has been under way quite long enough for Bell to have known about it. The days when genetic problems can be fixed only by finding new breeding stock are now over.

Tales of Old Earth is the stellar Michael Swanwick at the top of his form, and hardly less so in the one tale here you never saw before. "The Raggle Taggle Gypsy-O" pits an archetype

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against the gods in the name of true love and manages to explain one of the primordial motifs of song in the process.

The other eighteen stories of the collection include several prize-nominees and prize-winners and are more familiar. All are from the nineties, and every one is a pleasure worth revisiting.

Science fiction and fantasy long wore an image of white and male. WASP was in there too, but there were too many names such as Asimov and de Camp, Van Vogt and Heinlein, Weinbaum and Gernsback for that to maintain a straight face. Male, though—the women were there but hiding behind androgynous names such as André (Norton) and cryptic initials such as C.L. (Moore).

White? The early SF magazines weren't big on photographs, and readers were free to think of the writers as any color they wished. Since white dominated the culture, it is not surprising that they thought of the writers as white. Black was washed out by blind expectations.

But it was there. Black did not come to SF only with the advent of Samuel R. Delany and Octavia E. Butler, though they did make the Black presence much more prominent. Today we have Nalo Hopkinson, Steven Barnes, and a number of others. And in 1887 Charles W. Chestnutt published "The Goophered Grapevine" in *The Atlantic Monthly*. In 1920, W. E. B. Du Bois published "The Comet." In 1931, George S. Schuyler had "Black No More."

Most of the stories in **Dark Matter: A Century of Speculative Fiction from the African Diaspora** are contemporary, but editor Sheree R. Thomas has done us all a service by including the older tales, along with a handful of essays by Delaney, Butler, Charles R. Saunders, Walter Mosley, and Paul D. Miller. The result is a vision of Blacks and their situation in America through the SF lens.

It is worth noting that that lens has enabled an enormous amount of social criticism. In the old Soviet Union, SF was about the only way a writer could criticize the system. White American writers have used it so as well, but we must admit that criticism carries less bite when it comes from members of a culture's dominant group, though it may be no less justified or heartfelt.

It's that time of year again. But if you're thinking of trekking down south to join the party, pick up a copy of **Mardi Gras Madness: Tales of Terror and Mayhem in New Orleans** first. Once you've read of some of the things that just might happen down there—human sacrifice to Old Man River, ghouls and Cthulhu in the cemeteries, masks and ghosts, eleven visions from the likes of Bruce Holland Rogers, Charles de Lint, David Bischoff, and Elizabeth Ann Scarborough—you just might change your mind.

James Gifford is a Heinlein fan who feels that far too much of the writing about Heinlein and his works is based on too-small samples of the Master's work. To aid and abet more broad-based treatments, he has written **Robert A. Heinlein: A Reader's Companion**. The book bills itself as "The Complete and Authoritative Guide to the Works of Science Fiction's Grand Master," and indeed it covers the complete *oeuvre* and is rich with details of motivation, context, and history. But if you're looking for plot summaries, you won't find them; the abiding assumption seems to be that the reader has read the story under discussion and understands Gifford's referents. Nor will you find much critical, evaluative content, for Gifford deliberately eschews most of that, saying in his introduction that "It is not possible to write with any depth without at least a component of criticism creeping in . . . but my effort has been to present the facts and leave interpretation to the reader of the works themselves."

If you're not familiar with Heinlein,

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this one won't change that (though it may impel you to see what the fuss is about). If you're a Heinlein fan or scholar, however, you will find this an interesting addendum to your collection.

Because Charles Sheffield is one of those who takes seriously the "science" in "science fiction," he has long fitted nicely into this magazine. Here and elsewhere, he has committed a wealth of memorable stories, as well as a horde of essays about new developments in science.

Borderlands of Science carries the subtitle "How to Think like a Scientist (and Write Science Fiction)." The instruction comes down to "respect the facts"; to show what he means, Sheffield presents a perfectly dreadful example of disrespect for facts, involving an alien species with a recorded history that stretches back for forty billion years (well beyond the birth of the universe!).

Just the facts, Ma'am? Sheffield covers a *lot* of ground when he turns to those, ranging through cosmology, physics, chemistry, biology, astronomy, spaceflight, computers, nanotechnology, and future war to the heresies on the cutting edge, some of which (like the dinosaur-killing asteroid) become accepted as fact, and some of which (like cold fusion and ESP) become accepted as bunk. The result is a nice overview of modern science without the technicalities of a textbook. It should, as advertised, prove useful to SF writers, but also to readers who wish to know a little more about what their favorite writers are pitching at them. ■

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BRASS TACKS

Dear Stan,

I beg to differ with your September editorial, "Leap of Faith". Consider that the cheetah is a quantum leap faster sprinter than we are; the dolphin is a quantum leap better swimmer than we are. Similarly, our physiology is specialized to support our brain to the extent that I believe that Homo Sapiens is a quantum leap more intelligent than the competition. (If it is not on Earth, it is not competition . . . yet.) I would like to refer you to Richard Leakey's excellent book: "Origins Reconsidered", which identifies either directly or by bibliography several of the compromises which our ancestors developed in order to support our brain. To paraphrase Heinlein, the horse can indeed be taught calculus, but it may take a few million years.

Every animal alive abstracts data in order to act upon it. The frog is hard-wired to recognize a fly, and to capture it. If it isn't a fly, the frog doesn't even see it. This is an internal, hard-wired abstraction process. Our brain is more capable of rewiring the hard-wired abstraction process. Crows cannot count past three. If four people enter a field, and three leave, the sentinel crow thinks that the field is empty. Our ability to count ad-infinitum makes us smarter at math than crows by a quantum leap. There is a tale told of a chimpanzee which was given tokens for work done. The chimp was allowed to ride on the doctor's shoulder after payment of a few tokens. On one occasion, a dog entered the room, the chimp grabbed the requisite tokens, and jumped up on the doctor's shoulder. I submit that predicting the effect of a $.10 rise in crude oil price on the GNP is a quantum leap more difficult than trading in tokens on rides.

If you excite an atom by a certain amount of energy, a quanta of light is produced. That quanta does not change until you excite the atom by enough energy to produce a different quanta. The principle of excitation has not changed, but the quantum level has. Similarly, we think in identical patterns of other members of Terra Gens, but the quantum level is different.

William Melgaard

Your description of what happens to an atom is not quite right, and not an appropriate analogy for the evolutionary article. To say that a cheetah is a quantum leap faster than a human is like saying that an excited state of oxygen is a quantum leap above the ground state of hydrogen. It isn't; quantum leaps happen within a single atom, and evolutionary changes happen within a single line of decent. A cheetah is a lot *faster than a human, but it's not a leap, quantum or otherwise; it's the product of a separate process.*

Dear Dr. Schmidt:

I'd like to offer two thoughts in response to your editorial "Leap of Faith". One indirectly related, and the other stimulated directly by your arguments.

The first has to do with consciousness, which is a topic in vogue at the moment among the kind of people who discuss what makes humans unique, or not.

The electronic revolution has taught

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us which computational tasks are truly difficult. Arithmetic calculation is a snap. So is algebra. Even calculus can be done far more quickly by machines than by we 'advanced' humans. The machines don't even break a sweat.

The task that turns out to be so tough that even the most powerful machines cannot compete with a human toddler is pattern recognition. A human being can do pattern recognition all day that the best machines are utterly incapable of. Something truly brainless, like watching a sitcom on television—recognizing the characters and getting the jokes—takes pattern recognition skills that machines cannot begin to manage.

To my mind it is clear what humans excel at—pattern recognition. We are pattern recognition machines. We are so tuned up to recognize patterns that when presented with something chaotic, like a TV screen filled with static 'snow', our brains keep turning up the 'gain' until we begin to see patterns that aren't there. We are so hypersensitive to patterns that when they are utterly absent, as in a sensory-deprivation tank, the human brain hallucinates—again perceiving patterns where none exist.

So, if pattern recognition is the 'hard stuff,' what is its relationship to consciousness? Simple. Consciousness is the pattern recognition machine recognizing its own patterns.

Once the pattern recognition machine closes the loop, it becomes infinitely recursive. It can think about itself thinking about itself. That way lies sentience, and perhaps humanity.

And that leads us to the second topic. . .

As you argue in your editorial, the human pattern recognition machine did not spring into being without precedents. It is highly likely that there exist other pattern recognition systems among terrestrial life forms that have advanced to the point of self-recognition. Does that mean that humanity is unique only in quantity, not in kind?

Not necessarily. Before this evening I would have said certainly. But I have not defected to the other camp. I've set up my own tent instead.

Many science fiction stories have explored the idea of a singularity, a breakthrough, a crisis or a cusp in the evolution of a species—often man. We can see that other species have most certainly passed through a critical point in their evolution that forever changed their destiny.

Take the case of flying animals. Early in their evolution it is almost certain they were gliders rather than fliers. A flying squirrel cannot gain altitude—it does not have the flight muscles. How long does it take a flying squirrel to evolve into a bat? No matter. At some point the creature passes a critical point where it can maintain altitude. Soon after it becomes capable of gaining altitude. The day the species first has the power to gain altitude it has passed a cusp in its evolution. It has achieved full powered flight. It is no longer the creature it was. It is now a flier, a creature of the sky.

Perhaps humanity has passed a cusp in the evolution of its pattern recognition machine. An unbiased observer, looking about planet earth, would have reason to suspect humans differ from their biological cousins in some significant manner or another. Could it be that our pattern recognition machines have achieved the analog of powered flight?

Pattern recognition is the tough problem. We are just beginning to learn how it is done. It is perhaps not surprising we don't yet see where the cusp might be, or what the significance of it is. But once we suspect a thing exists, finding it becomes more likely. Even inevitable. We're good at that kind of thing!

Ed Bianchi

Stan,

I agree completely [re: your September editorial]. The higher mammals—and cetaceans, etc., (not to be too parochial)—differ from humans in only

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the tiniest degree. Even as our genes are highly similar. . .

To maintain the opposite is a relic of Creationism, and not 'ironically close'. . . Religion, in general, has promoted the special status of 'Homo sapiens.'

I have a friend in a nursing home, the victim of an aneurysm some years back. She has lost 99.9% of her speech, and has quite a bit of difficulty in communication. There's no doubt whatever that she remains 'human.' But a chimp, or a dog, with only slightly less speech ability is (by some) relegated to a vastly inferior status.

Let me switch to another topic.

I've recently been struck by the realization that there are an awful lot of people. Consequently, an idea is not apt to be my exclusive property - I may be smart, but not THAT smart. So. . . if I can see the general shape of things to come, there must be thousands, even millions of others with roughly the same vision. It's a sobering thought, but one which you might enjoy playing around with.

Warren Rayle

Hi Stan,

I enjoyed reading Thomas Donaldson's article "Neuroscience and other intelligences" in the September issue. One comment: although all animal (and human) brains work on basically the same principles (as Donaldson points out), it's interesting to consider the differences in brain structure among the species. For example, Donaldson asks us to imagine an animal with little "neocortex" and a large cerebellum. There is such an animal—it's called a fish. The brain of every animal has to solve the same set of problems—finding food, finding a mate, avoiding becoming someone else's dinner—but the manner by which each animal's brain solves the problems, or how it "computes," is quite different and is reflected in its particular neural structure. So, presuming this holds true across the Universe, the extent to which we can communicate with any given species would correspond to the similarity of our problem-solving skills (and, thus, the similarity of our neural structures).

I also enjoyed your September editorial. I, too, have witnessed remarkably caustic arguments over the question of animal language and thinking skills. But here's the thing that gets me: no one in these debates has ever to my knowledge given a precise definition of "language," or any of the other cognitive skills in question. So how are we supposed to tell if an animal possesses an attribute when no one has ever defined it? It's no wonder these debates are passionate—the arguments are mostly emotional and will continue to be until these scientists come up with a way to define what it is they're talking about.

One more thing: please keep publishing stories by Charles L. Harness. He's rapidly becoming one of my favorite authors.

Kyle Kirkland, Ph.D.

Dear Dr. Schmidt:

I enjoyed Stephen L. Burns's latest contribution ("Night Voices," 09/2000 *Analog*) and look forward to more of his work. It came as a great surprise that he let his exuberant sense of humor take a back seat in one of his stories.

Perhaps the contrast in tone with his previous stories had as much to do with it as the air of logical inevitability of the current one, but the urge to analyze became overwhelming.

The premise of a world whose virulent microbes necessitate that the intelligent inhabitants immediately burn their dead, invites speculation. There is an obvious objection to their having evolved to such a situation—their evolutionary predecessors would have had to adapt to the plague environment without being able to cremate their dead. There is the logical alternative that the intelligent aliens evolved before they had to deal with an environment seething with deadly microbes. One way this could

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have happened is if, at an earlier stage of technical and social development, they had themselves created and released a swarm of pestilence.

The reader's appreciation of "Night Voices" might be enhanced by comparing and contrasting it with another SF story, "Dark Mission" by Lester Del Rey—that is, if that 1943 story is still accessible.

Once again, I look forward to Mr. Burns's next story!

Kurt Foster

Stephen L. Burns is a writer of exceptional range, and his earlier stories have ranged from very funny to very serious and back again, several times.

Dear Dr. Schmidt:

Tom Easton's review in the September issue of "The Light of Other Days" by Arthur C. Clarke and Stephen Baxter really struck me. The title is almost identical to a story in the August 1966 issue, "Light of Other Days" by Bob Shaw, about 'slow glass' in which the speed of light is v-e-r-y slow. The theme goes back to an Isaac Asimov Story "The Dead Past," April 1956, in which you could view the past—and the past begins a fractional second from now. Clarke is older than me and a clever man; I can't imagine he is unaware of these stories. A good theme is a good theme. I've got to get the book!

John Aurelius,
Indianola, WA

I believe the title was intended as a deliberate tribute to Bob Shaw's story.

[Stan,]

As usual, I enjoyed reading the September, 2000 issue from cover to cover. Also, as usual, I have some comments thereon.

The story "Identity Crisis" by Kevin J. Anderson was well thought out and very readable until I reached the end of the story. Either the author is planning a sequel or simply ran out of ideas. As it reads, the ending is not plausible given the description of the capabilities of Daragon. Eduard can run but he cannot hide. Daragon has both the means and the motive to find Eduard.

"Night Voices" by Stephen L. Burns was wonderful! It held together and flowed to an acceptable conclusion.

"Jurisimprudence" by H.G. Stratmann, "Executive Committee" by Alan L. Lickiss, and "Playmate" by Charles L. Harness all were enjoyable to read, well written, and plausible.

"Reflections" by Jayge Carr was also a good story with a good plot and conclusion.

C. Henry Depew
Tallahassee

Dear Dr. Schmidt:

RE: Animal, Human, and Other Intelligences

Animals communicate by "body language." Mammals such as dogs that have associated with humans for generations are pretty good at reading human body language, so much so that it seems as if dogs are telepathic. Maybe ants communicate brain-to-brain when they touch antennae.

The fact remains that humans communicate vocally with phonemes that are pretty well standardized within a tribe or nation, and our cousins the apes need to be trained by humans before they can use sign language or type on a computer. They did not evolve this ability by themselves. The studies of animal intelligence are good, but in my experience animals share with less enlightened members of the human race fairly simple desires to find dinner wherever it may present itself and spread their DNA around as widely as possible.

Also there is a difference between classes of human societies, which cuts across races—there are civilizations that developed written records of their spoken languages and primitive societies which are limited to oral traditions.

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Granted that the oral traditions of tribes without writing are as impressive as the epics of Homer, when a society begins to use written words, a qualitative milestone in evolution is crossed.

Maybe this is the kind of thing editors think of the day after they finished writing an editorial to meet a deadline; but I have come to the conclusion that the anthropological doctrine of cultural relativity, which I found credible back in 1948, ignores the difference between civilizations and purely oral societies.

W. F. Hoey
Roseville, CA

Need I point out that humans also need to be trained by other humans before they can use language?

Dear Stan,

Anent your editorial, "Leap of Faith," there are some interesting items about "animal intelligence" that are worth mentioning.

As a rule, pre-medical students take a course called "comparative anatomy," wherein the human components are contrasted with that of other animals, showing that basic structure is topologically homeomorphic. Distorted, to be sure, but there is sufficient similarity so that the dissection of a frog, for example, will give a student a pretty good idea of the kind of makeup the human structure has. One of the truly interesting works is Jane Goodall's book, "In The Shadow of Man," wherein she observes chimpanzees in the wild. She relates many of the things that chimps do in the wild—things that show intelligence and initiative.

Anyone who's been around computers long enough has heard of the Turing test: if you communicate over a terminal with some source, and you can't tell whether what you're talking to is a person or a computer, if it's a computer, it's passed the test of being an aware entity. Now the actual validity of "artificial intelligence" has to be a bit more rigorous; but in any case, the behavior of "intelligence" is a matter of reaction to the outside world. Until and unless we all become telepaths, we can't be certain that anyone outside ourselves is truly "intelligent" as opposed to responding automatically to various stimuli. So, if a dolphin, primate, or psitticene performs something that looks like the result of conscious thought, they should get as much benefit of the doubt as any human.

I doubt that there's a person who's had a household pet beyond ("above") the reptilian who hasn't seen some demonstration of at least primitive thought at one time or another. Cats, dogs, and other mammals, particularly the carnivores, have shown the ability to solve problems and learn how to take advantage of circumstances. Coyotes have taught themselves to "hitch rides" on railroad flat cars. Gorillas have figured out how to make mattresses from saplings, including how to tie primitive knots. Otters have learned how to use small rocks to help them open bivalves.

To go from the sublime to the bemusing, in 1999, in Clearwater, FL, State Troopers spotted a car heading down U.S. Highway 19, with an iguana at the wheel, according to a news report in the Tampa Tribune. The lizard, named Finley, had his claws on top of the driving wheel, according to the officers. His owner, whose blood alcohol was reported to be 0.29 percent, let Finley do the driving. According to one of the officers, the lizard "drove OK," and seemed to keep the car in the lane better than his owner.

So much for the uniqueness of humans.

In Florida, maybe a Designated Iguana isn't a bad idea.

Steve Kallis, Jr.

Dear Dr. Schmidt,

There has been a lot of talk about animal intelligence from the scientific-proof point of view and from

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religio-philosophical points of view. I would like to propose a pragmatic point of view.

We decide that children have become adults at an arbitrary age. I say arbitrary, because no one seriously believes that at midnight on the night before a young person turns 18, or 21 (or 16, or 30 or any other age) maturity is suddenly infused. We have an arbitrary age because we have to draw the line somewhere.

If you are correct in your September 2000 editorial in theorizing that intelligence is a slow-evolving process, and that the great apes, dolphins, etc. are farther along on that road than some humans might like to admit, it is all the more necessary for us to have an objective, practical, yes, *arbitrary* definition of intelligence, written into law. To put it bluntly: If apes or dolphins attain our stated, written, legal definition we do not have the right to imprison them in laboratories or giant aquariums against their will.

And what should this practical definition be? I can't remember the source somebody German I think—but some philosopher or scientist is supposed to have said, "If any animal could learn language well enough to use the word "I" correctly, that one should be given the same protection as a human." The normal human child learns, by about 3 years of age, that the very same person can be "I" or "You" or "She" depending on who is speaking.

The last I heard (I'm ready to be corrected on this) no experimental animal was using the pronouns consistently and correctly. (i.e., a laboratory ape will type "Lana wants the box" not "I want the box." "Tim tickle Lana?" not "Will you tickle me?") The consistent, correct use of the pronouns implies a self-awareness and an other-awareness that goes beyond the merely instinctive.

It's as good a definition as any, but some definition we must have.

Edith S. Tyson
Warren, OH

Arbitrary definitions written when you've barely begun to study the range of possibilities, and their possible multidimensionality, are more than arbitrary—they're dangerous! The ape you describe is conveying the same information with a different formalism—just as any human language makes some distinctions that others don't, and vice versa.

Dr. Schmidt:

Re: the article on P. 40 (September, 2000): *Neuroscience and Other Intelligences* by Thomas Donaldson.

First off, the title states that neuroscience is itself an intelligence. I don't believe the author meant that. The title might better have been *Neuroscience and Intelligence,* but that's quibbling. I have a more substantial objection to the section on *How Our Brain Works:*

Donaldson uses the term "neural network" to describe brain wiring, but the term has a specific meaning among researchers in the field: a neural network is a collection of analog operational amplifiers, each connected to all of the others. Neural networks are used in studies of artificial life (AL), which is different from artificial intelligence (AI). In AL, the network is given a goal, and by trial and error, evolves a way of arriving at it. In that sense, it does what a brain does. In AI, the network is a collection of digital circuits—a computer—which is programmed for a particular task (or a series of them). Because of that programming, the AI device is incapable of exercising judgement except in very special cases that are also programmed, an example being the logical application of "if X, do this; if not X, do that or nothing."

In at least one respect, the brain operates more like a digital computer than a neural network: signals in the brain are transmitted as trains of spikes (ones or zeros), their rate being roughly proportional to the intensity of the stimulus.

Next objection:

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Donaldson implies that we won't be able to make computers duplicate what a mind does because new synapses are generated in the brain, and some neurons die, unlike what happens in a computer. That's a trivial argument. As our knowledge and technology grows, the time will come when a computer will be able to establish new connections when they're needed, and unlike the brain, the old ones won't atrophy from disuse, although the computer/brain may disconnect them for whatever reason.

I believe it's a mistake to compare the structural materials—wetware and hardware—when comparing brains and computers if that comparison is used as an argument for one being unable to do what the other does. Each medium has to make do with what's on hand. What's fundamental is the logical architecture and the nature of the programming—the hardware will follow. I also believe there are many similarities between the organization of the brain and that of the computer, and the organizations are an outgrowth of the means we've developed to solve problems—brains through millions of years of evolution, humans by making use of that evolution.

Ed Fairstein
Oak Ridge, TN

The author replies. . . .
Dr. Schmidt:

I have read Mr. Fairstein's letter carefully, and find no merit in any of his criticisms.

First, *Neuroscience and Other Intelligences* in no way suggests that "neuroscience is itself an intelligence." I do not know why Mr. Fairstein came to believe that. Second, more substantive, neural networks have been used by neuroscientists to explain one major fact about our nervous systems: how we can do some jobs quickly even though our neurons operate much more slowly than any single computer. However it is true that I did not give citations for my use of the term "neural network": Fairstein might look at the book by PS Churchland and TJ Sejnowski, *The Computational Brain*, as an instance of how this notion is used. For a study in almost in pure computer science, he might look at D. Pollock, *How To Build a Person* (which I do cite in Box 3, p. 43). The variety of neural network he suggests is only one among many, even in computer science. Many have studied neural networks precisely because they provide a model for brains which is *parallel* rather than sequential. Sequential models have consistently failed to give us any understanding of how our brains work.

He also objects to my suggestion that machines with changeable synapses and even death and replacement of individual neurons might no longer fit common definitions of "computer." At no time did I suggest that we could not build such machines; and even in this context, I did not *state* but only suggested this idea. We presently build many machines which aren't computers. If we find we aren't computers either, the problem of machine intelligence does not vanish.

I made this suggestion because it was quite unclear to me that a brain or machine with changeable connections and changeable "neurons" would *necessarily* fulfill the hypotheses of Turing's original theorem. Why? Because Turing's machine, though it has an infinite memory (itself impossible for a real computer) remains constant, with the same operations, as a machine. Our own memories don't work like those of a computer, on a "tape" or even a collections of tapes; by changing their connections, our neurons also carry out different *operations*. Still, I definitely did not state this point as a truth, but only a suggestion.

I will also add, however, that Turing did not consider timing at all, while the time a computer takes to do *any* operation plays a major role in its real ability to do it.

Thomas Donaldson
Australia

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UPCOMING EVENTS Anthony Lewis

2–4 February 2001
SHEVACON 9 (Tidewater area SF conference) at Wyndham Roanoke Airport, Roanoke, Virginia. Artist Guest of Honor—L. A. Williams, MC—Rikk Jacobs. Registration—$20. Info—SheVaCon, Post Office Box 416, Verona VA 24482-0416 phone—(540)248-4152 e-mail—<sheva@adelphia.net> URL—<www.shevacon.com>

16–18 February 2001
BOSKONE 38 (New England SF conference) at Sheraton Framingham Hotel, Framingham Massachusetts. Guest of Honor—George R. R. Martin, Official Artist—Charles Vess, Special Guest—Jack Cohen, Featured Filker—Juanita Coulson. Registration—$36 until January 2001, more at the door. Info—Boskone 38, Post Office Box 809, Framingham MA 01701 fax—(617)776-3243 URL—<www.nesfa.org/boskone/flyer.html>

23–25 February 2001
AD ASTRA 2001 (Toronto area SF and Star Trek conference) at Holiday Inn, Don Valley, Toronto, Ontario, Canada. Guest of Honor—Connie Willis. phone—(905)305-0827 e-mail—<ad-astra@home.com> URL—<www.ad-astra.org>

30 August–3 September 2001
MILLENNIUM PHILCON (59th World Science Fiction Convention) at Philadelphia Marriott, Philadelphia, Penn. Guests of Honor—Greg Bear, Stephen Youll, Gardner Dozois, George Scithers, TM—Esther Friesner. Registration—$145 [rates may go up]; supporting $40. [These are the latest rates posted on the Internet as of the time this column went to press.] This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info—Philcon, Box 310, Huntingdon Valley, PA 19006. email—<philcon2001@netaxs.com> URL—<http://www.netaxs.com/~phil2001>

26–29 October 2001
WORLD FANTASY CONVENTION 27 at Omni Bayfront, Corpus Christi, Tex. Guests of Honor—K. W. Jeter, John Crowley; TM—Joe Lansdale. Registration—$105 until 15 October 2000, then more. Info—WFC 2000, Box 27277, Austin, TX 78755. phone—(512)835-9304 fax—(512)835-7637 email—<fduartejr@aol.com> URL—<http://2000.worldfantasy.org>

Convention runners: If your convention has a telephone, FAX, email, or Web page URL, please let us know so that we can publish this information.

Convention attendees: When calling conventions for information-do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an IRC if the convention is in a different country. ■

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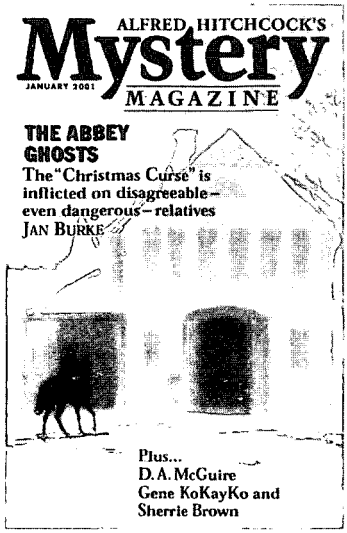

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